This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LANE MEDICAL LIBRARY STANFORD
2 45 0445 1230

610.41
S982
1847
V. 1

—PRESENTED TO—

The New York Academy of Medicine.

By

The Society of the New York Hospital,

March, 1898.

[illegible] M. D.

TRANSFERRED TO LANE
LIBRARY FROM ANATOMY

LANE LIBRARY, STANFORD

610.41
S982
1847
v.1

—PRESENTED TO—

The New York Academy of Medicine,

By

The Society of the New York Hospital,

March, 1898.

TRANSFERRED TO LANE
LIBRARY FROM ANATOMY

LANE LIBRARY, STANFORD

THE

SYDENHAM SOCIETY

INSTITUTED

MDCCCXLIII

LONDON

MDCCCXLVII.

ON THE

INJURIES AND DISEASES

OF

BONES.

BEING SELECTIONS FROM THE

COLLECTED EDITION OF THE CLINICAL LECTURES

OF

BARON DUPUYTREN

SURGEON-IN-CHIEF TO THE HÔTEL-DIEU AT PARIS.

TRANSLATED AND EDITED BY

F. LE GROS CLARK

ASSISTANT SURGEON TO, AND LECTURER ON DESCRIPTIVE AND
SURGICAL ANATOMY AT, ST. THOMAS'S HOSPITAL.

STANFORD LIBRARY

LONDON
PRINTED FOR THE SYDENHAM SOCIETY
MDCCCXLVII.

PRINTED BY C. AND J. ADLARD,
BARTHOLOMEW CLOSE.

EDITOR'S PREFACE.

In acknowledging the honour which the Council of the Sydenham Society has conferred on me, in requesting me to translate and edit a Volume, comprising all the papers on the Injuries and Diseases of the Bones, contained in Professor Dupuytren's 'Leçons Orâles,' I take the opportunity of subjoining the following introductory remarks, in explanation of the scope, objects and arrangement of the work.

In the original, the articles in question are scattered through the first two volumes of the 'Leçons Orales,' without any regard to appropriate collocation. Moreover, much confusion is the consequence of frequent and sudden changes from the first to the third person;—the Professor being made sometimes to speak in the former, at others in the latter; or, again, his Editors speak for him, or quote his opinions. In the translation it has been thought desirable to impart an uniform style to the work; as well as to render the French into corresponding idiomatic English as far as was compatible with a strict adherence to the meaning of the author. To carry out this intention a paraphrastic translation has been, in a measure, rendered essential. Compression also has been resorted to in details generally; and many of the cases have been abridged, especially in those parts of them which have no immediate reference to the subjects under consideration. In short, the object has been, to render the present treatise more acceptable to the English reader, by disencumbering the original of needless repetition and redundancy,—a process of condensation to which one cannot but believe that the author himself would have subjected the work, had he superintended its publication in a complete form; although it is not difficult to appreciate the motives of his able Editors, in retaining and enlarging upon all that fell from their esteemed preceptor.

It is, therefore, hoped, that the advantages offered to the Subscribers in the present Volume, may not be regarded by them as exclusively limited to the presentation of a work in the vulgar tongue.

Lengthened annotations would not be pertinent to the objects of the publication, as one of the Society's books; the foot-notes are therefore few and simply explanatory; and their apparent abruptness is due to their brevity. Occasionally, when an abstract is very much abridged, the passage is placed between brackets; and when single words are introduced in parenthesis, they are intended to aid in rendering the meaning of the author more intelligible and precise, where the original is deficient in these respects.

The convenience of the French word "*fragment*," as applied to either division of a fractured bone, has led to its adoption, in this sense, in the translation: and the word "sign," as it relates to fractures and dislocations, has been employed in its restricted application to visible and tangible evidence of injury, in preference to the more generic word "symptom."

A biographical sketch of the author has been drawn up and prefixed, in the hope that it may add to the interest of the volume.

The plan of teaching adopted in the present work, is that in which doctrines and principles are largely illustrated and enforced by cases,—a method which has received the sanction of our own most eminent and practical writers; and which possesses the peculiar advantage of adding to our stock of facts, whatever may be the varying interpretation and application of those facts, as science advances. In this respect the 'Leçons Orales' are peculiarly rich; and though there are theories advanced and points of practice advocated, which are not entirely proof against criticism, yet it will be found, for the most part, that the former are sound, and that the latter constitute a valuable series of precedents, to guide the practitioner in parallel circumstances.

F. L. G. C.

LONDON, *Dec.* 14*th*, 1846.

BIOGRAPHICAL SKETCH OF THE AUTHOR.[1]

GUILLAUME DUPUYTREN was born on the 5th October, 1777, at Pierre-Buffière, a small town of Haute Vienne. When only three years old he was kidnapped by a rich Toulouse lady, who was travelling, and whom the attractive appearance of the child had tempted to carry him away with her. His father soon recovered him; but in 1789, a cavalry officer who was stationed at Pierre-Buffière, took a fancy to the boy, and begged his father to permit him to accompany him to Paris. The older Dupuytren, being an advocate of small fortune, willingly accepted the offer; and the lad was forthwith placed in the College of La Marche, where he speedily distinguished himself, especially in philosophical studies.

After the revolution had broken out, Dupuytren was of an age to make choice of a profession, and that of surgery was at once selected. When scarcely eighteen he was appointed anatomical prosector in one of the schools established by Fourcroy: and in 1801 he was advanced to the head of his department of teaching. He then occupied himself actively in physiological and pathological pursuits, and published several memoirs, some of which where written by himself, and others conjointly with his friend M. Dupuy. In the autumn of 1804 there was a vacancy for a surgeon of the second class in the Hôtel-Dieu, for which Roux, Tartra and others competed with Dupuytren; but the last was the successful candidate. In 1808, he gained another step: and when, in 1811, the death of Sabatier left the chair of operative medicine unoccupied he offered himself, and the *concours* again decided in his favour. On this occasion he selected "lithotomy" as the subject of his thesis.

---

[1] This sketch is partly abridged from the eulogistic memoir prefixed to the last edition of the 'Leçons Orales.' The editor has also availed himself of the brief, but graphic, sketch of M. Dupuytren in the work entitled 'Etudes de l'Homme dans l'Etat de Santé et de Maladie,' by J. H. Reveillé Parise, M.D. Paris, 1845.

Shortly before the first operation for ligature of the subclavian artery was performed, Dupuytren had desired to undertake it at the Hôtel-Dieu, but was prevented by the superior authority of Pelletan, who was then surgeon-in-chief. In 1815, however, the latter accepted the appointment of honorary chief of the hospital, and the subject of this memoir then became the acting chief surgeon. Having thus obtained the object of his ambition and an independent position, he soon distinguished himself in the department of clinical surgery, of which he may be regarded as the founder in the French school.

From the period of his nomination to the Hôtel-Dieu until ill health obliged him to seek change in Italy, he rose daily at five o'clock, and paid his first visit to the hospital from six to nine in the morning, and his second from six to seven in the evening. After traversing the wards, he delivered a clinical lecture in the amphitheatre appropriated for the purpose. His voice, at first low and indistinct, rose as he proceeded, and his language was impressive and eloquent. He usually treated of those subjects which, from their frequent occurrence, are the most useful for students to become acquainted with; and would pass in review several diseases in one lecture: as he was scarcely ever known to miss paying his accustomed visit, the mass of information thus imparted in the course of the year, was very considerable. He expected from others the same rigorous exactitude in the performance of their duties, as he himself was in the habit of practising. All the post-mortem examinations were conducted in his presence: and he was very particular in noting the influence of seasons and peculiarities of constitutions in surgical diseases.

He regarded an operation as an evil alternative which nothing short of positive necessity should induce the surgeon to adopt. But when it became indispensable, he displayed admirable dexterity and coolness: and his resources were always equal to the difficulties he met with. After the completion of an operation he explained the motives of all he had done with clearness and precision. Dupuytren by no means belonged to that class of operators who attach great importance to rapidity of movement: and although very dexterous with the knife, when he pleased, he never displayed this power to the sacrifice of other and more important considerations. He justly maintained that the success of an operation was mainly dependent on the after-treatment; and never undertook one without previous careful preparation of the patient.

Some idea of the extent of practice seen by this eminent surgeon may be formed by the calculation that he performed, at the Hôtel-Dieu in 1818, three hundred and sixty-eight surgical operations, that he set one hundred and seventy-eight fractures, and opened three hundred abscesses.[1] During this year the total number of patients admitted into the surgical wards was, two thousand three hundred and fifty-three: of the cases operated on, two hundred and twenty-eight, or five eighths were cured. Besides the patients in the hospital, he daily saw and prescribed for a great many out-patients, who flocked from afar to seek his advice.

Strongly impressed with the importance of observation, he required his house-surgeons to keep an accurate history of the most interesting cases; and at certain intervals he looked them over and revised them. These records fill more than a hundred large volumes in folio; and were destined, had his life been prolonged, to have formed the basis of a system of surgery; but they constitute a noble monument of his own laborious pursuit of science, and an invaluable legacy to those who come after him.

---

[1] An enumeration of these may be interesting to the English reader; the list is therefore subjoined. Fistulæ in ano, 16; ligatures of the carotid, femoral, and radial arteries, 7; cataracts by depression, 57; by extraction, 3; artificial pupils, 3; excision of skin for entropion, 9; excision of conjunctiva for entropion, 5; fistulæ lachrymales, 4; strangulated herniæ, 44; dislocations, 26; fractures of the femur, 26; of the arm, 18; of both bones of the leg, 14; of the tibia alone, 11; of the fibula, 13; of both bones of the fore-arm, 7; of the radius, 14; of the ulna, 2; of the olecranon, 2; of the clavicle, 12; of the patella, 3; of the head, 7; of the vertebræ, 2; of the ribs, 38; of the tarsus, 2; of the carpus, 1; of the metatarsus, 1; of the phalanges, 2; sequestra removed, 24; caries, 16; urinary calculi, 7; hydrocele, 9; paraphymosis, 8; nasal polypi, 7; polypi of antrum, 1; of the ear, 1; of the womb, 4; cancer of the eyelids, 1; of the lower lip, 6; of the commissure of the lips, 1; of the tonsil, 2; sublingual, 1; of the breasts, 17; of the penis, 1; of the labia, 1; osteo-sarcoma, 4; amputation of the upper jaw, 1; of the lower jaw, 1; removal of the maxillary tuberosity, 1; artificial anus, 3; excision of the elbow, 1; amputations of the thigh, 10; of the leg, 2; of the arm, 2; of the fore-arm, 1; of the testicle, 1; extraction of a ball from the head of the humerus, 1; erectile tumours, 4; encysted tumours and hydatids, 5; polycyst tumours, 2; fibrous tumours of the lower jaw, 3.

An unworthy jealousy of the reputation acquired by his contemporaries has been attributed to Dupuytren, and not without some colour of truth, for he rarely condescended to refer to the labours of others. His own original mind, and habit of investigating for himself, must no doubt have influenced him in this respect: yet he did not altogether omit doing justice to Scarpa, Astley Cooper, Larrey, Roux, and others amongst his predecessors and contemporaries, in his clinical lectures. Many again have asserted that he read but little: this, however, was not strictly the case. It is true that his active life did not permit him to shut himself up in his library: but if he did not read for himself, others read for him; and his quick perception and retentive memory afforded him the means of readily appropriating imformation thus obtained second-hand. He was in this way enabled to keep himself acquainted with whatever occurred of novelty or interest in the medical profession, in different parts of the civilized world.

Dupuytren was gifted by nature with a rare combination of qualifications necessary for the cultivation and practice of our noble profession. His quick eye, his steady hand, his imperturbable coolness, were united with a power of rapid discrimination and admirable judgment. He had a peculiarly happy manner of questioning patients, and eliciting the information requisite to form a just diagnosis: and he was not less felicitous in the communication of his conclusions and his reasons for forming them, to the students around him. When he gave a decided opinion, it very rarely proved to be erroneous.

In the foregoing eulogium, it is not intended to imply that Dupuytren was faultless and unerring, but merely that he possessed, in an unusual degree, that knowledge of disease, combined with ready tact in seizing on the prominent points of a case, which are so essential in our profession. In his capacity as professor, however, it is impossible to laud too highly his distinguished ability. Surrounded by three or four hundred pupils, he carried them with him by his graphic style, and never failed to impress the instruction he conveyed by the richness of his illustration. To verbosity, declamation, and the trickery of elocution, he had a rooted antipathy: his language was simple, and his enunciation distinct and deliberate. In short, his object was to teach, rather than to produce effect; and in this he was eminently successful.

In private life (say the Editors of his Leçons Orales) Dupuytren possessed many amiable qualities, though he has been charged with being of a haughty, despotic, and domineering disposition. His ear was never closed to the petition of the truly unfortunate; but ingratitude seemed in a measure to have repressed his natural sympathies, and to have engendered a repulsiveness and austerity of exterior, which were thrown aside when in the company of children, or of those who knew him intimately. His originalty, his varied information, and, above all, his humour, rendered intercourse with him extremely agreeable.

It is, of course, difficult to gainsay remarks such as are embodied in the last paragraph, and which are expressive of the opinion and feeling of friends who were on terms of intimacy with the subject of them. But we may be permitted to question the strict impartiality of statements, which are certainly at variance with the general impression of those who knew and acted with Dupuytren. His conviction of his own superiority, and his excessive ambition, made him jealous of the reputation of his contemporaries, and dogmatic in his own opinions, as well as tyrannical in the subserviency he expected from others; —features of character which, report says, he carried with him into private life. He was, moreover, fickle and capricious, and rarely permitted himself to yield to generous emotions; though he could descend to acts of meanness when he had an end to gain. He consequently had but few friends, and probably never tasted unmixed pleasure in witnessing the success, and aiding in the advancement, of those who were in any way likely to be brought into competition with himself: of Bichat he was reported to have been especially jealous.

In his aversion to criticism, Dupuytren was by no means peculiar; and some allowance in this respect is to be made for him, when we take into consideration that he was spoiled by the fulsome flattery of those who surrounded him. His love of this deleterious draught seems indeed in some degree to have influenced his life, and directed his energies, which thence derived a discursive character, that prevented him from acquiring so enduring a reputation, as his great talents and rare advantages might otherwise have ensured. It is true there are few subjects in surgery that he touched, which he did not enrich by his originality of observation and great experience: yet he appeared to be actuated by a desire to shine pre-eminent in all; and thus in a measure sacrificed to the enjoyment and fruits of the present, the prospect of more lasting posthumous fame.

In his general appearance, and in many of his habits, there was a simplicity which one would be disposed to call affected, if it did not savour rather of the parsimony which was early enforced by pinching necessity, but which was subsequently cherished and strengthened, until the love of accumulating money became a ruling and absorbing passion: this enabled him, who at seventeen was forced to mend his own clothes, to leave at fifty-eight an enormous fortune, which had been amassed by his own unaided efforts. His costume was unvaried, as all who attended him round the wards of the Hôtel-Dieu can testify: and the little cocked hat and gray surtout were scarcely more distinctive of the Emperor, than were his old green coat and high apron characteristic of the Professor.

Impartiality further requires that some notice should be taken of his habitual neglect of courteous bearing to those around him, and of the want of considerate tenderness in his dealings with the suffering poor who were placed under his care; —qualities the exercise of which at once bespeak gentle breeding and a kind heart. It is probable that the characteristics in question were more assumed and apparent than real; but the partiality which would excuse the defects spoken of, on the ground that the mission of such men as Dupuytren is to be useful, and that society has no right to demand more of them than the fulfilment of their duty, is to be reprobated as involving a principle which is equally absurd in itself and mischievous in its tendency. So far from justifying or even palliating such imperfections of character, they should be scrupulously exhibited in their true light, for the benefit of the young, whose instinctive desire it is to adopt, as their models, those instructors who have obtained a legitimate ascendency over their minds;—a tendency which too often leads to the appropriation of the superficial defects of genius, when the loftier qualities are beyond the reach of the imitator.

As it is always interesting to meet with a redeeming trait in a selfish character, so it is a pleasing task in the present instance to notice an anecdote which does honour to Dupuytren's heart: it is narrated in the biographical sketch appended to the 'Leçons Orales.' Understanding that Charles the Tenth, when in exile, experienced privations from his limited means, he offered that monarch a million of francs. The ex-king at first accepted the generous proffer, but afterwards declined it with gratitude, as the improvement of his finances rendered the transmission of the money unnecessary.

For many years Dupuytren continued in the uninterrupted enjoyment of health, a large and lucrative practice, and the reputation of the first surgeon in France. His laborious duties in public and private at length demanded some relaxation both of mind and body; for his health received a shock, from which he never entirely rallied.

At the close of 1833, whilst on his way one morning to the Hôtel-Dieu, he had a slight attack of apoplexy. Yet, in spite of his indisposition, he went through his ordinary duties; but, during his lecture, his pupils perceived that he articulated with difficulty. He was bled immediately on his return home; and when sufficiently recovered he made a tour through Italy. His heart, however, seemed to be constantly turning to the Hôtel-Dieu and his duties at home, whither he soon returned.

His reappearance amongst his pupils was welcomed with enthusiasm: but it was apparent to his friends that his enfeebled frame was incapable of supporting the continued excitement and exertion which his public duties entailed; and one of them represented to him the necessity of seeking some respite from his toil, and recruiting his health by repose: his reply was "le repos, c'est la mort."

Not long afterwards he was obliged to relinquish his attendance at the hospital; and during the period that he was acting as judge in a *concours* at the Faculty of Medicine, he became the subject of chronic pleuritis. In spite of recommendations to the contrary, he determined on visiting Tréport, and returned worse than when he set out. For a time he was unwilling to admit to himself the serious nature of his malady, until the progress of the disease rendered it impossible to dispute its probably fatal termination. His professional attendants were divided in opinion as to the propriety of relieving the chest by paracentesis; but when the idea was suggested to the patient, he remarked that it was of little consequence, as he was persuaded he must die whether the operation were performed or not. Amongst his last thoughts was the creation of a chair of pathological anatomy; and he expired on the 8th of February, 1835.

As regards personal appearance, Dupuytren was of middling stature, well and strongly made, without being clumsy. The predominant expression of his face denoted the force and energy of his mind, mingled, however, with that superciliousness which was equally a part of his character. His forehead was high and ample, though somewhat compressed above and behind the external angular processes of the frontal bone. On the whole, in spite of his slovenly and even mean attire, the attentive observer could not but be impressed with the conviction that, in beholding Dupuytren, he was regarding a man of no ordinary stamp.

He was borne to his grave in Père-Lachaise by his former pupils, and followed by a great number of men eminent in science; as well as by a crowd of artisans, who held in grateful remembrance the substantial benefits for which they were indebted to the chief surgeon of the Hôtel-Dieu.

TABLE OF CONTENTS.

PAGE
Preface v
Biographical sketch of the Author ix

PART I.

ON THE INJURIES OF BONES.

CHAPTER I.

General considerations on fractures . . 1

CHAPTER II.

On several causes which may tend to hasten or retard the consolidation of fractures 19

CHAPTER III.

On the formation of callus; and on the means of remedying its faulty or misshapen deposit 40

CHAPTER IV.

On fractures of the upper extremity of the humerus, and on dislocations of this bone; with the diagnostic differences between them. On the reduction of dislocations, according to the method of White and Mothe . . 73

CHAPTER V.

PAGE
Cases of fracture of the clavicle and upper extremity of the humerus, treated by position 97

CHAPTER VI.

On fracture of the inferior extremity of the humerus, resembling dislocation backwards. Distinguishing characteristics of these two lesions. Rare cases of dislocation 102

CHAPTER VII.

On fractures of the lower extremity of the radius, resembling dislocations of the wrist 119

CHAPTER VIII.

On dislocations of the lower extremity of the ulna . . . 149

CHAPTER IX.

On dislocations of the thumb and fingers 152

CHAPTER X.

On original or congenital displacement of the heads of the thigh-bones . . 165

CHAPTER XI.

On fractures of the neck of the femur, their causes and treatment . . 187

CHAPTER XII.

On fractures of the patella 222

CHAPTER XIII.

PAGE
On fractures of the lower extremity of the fibula; and on dislocations and other casualties attendant thereon 234

CHAPTER XIV.

On dislocations of the astragalus from the os calcis. Practical considerations on the causes of this dislocation, and its treatment. Extirpation of the astragalus 316

CHAPTER XV.

On dislocation of the metatarsus . . . 326

CHAPTER XVI.

On fracture of the mastoid process 331

CHAPTER XVII.

On fractures of the zygomatic arch 333

CHAPTER XVIII.

On dislocations of the vertebræ, and diseases which resemble them; together with medico-legal considerations on these displacements. On fractures of the vertebral column 337

CHAPTER XIX.

On the reduction of old dislocations 367

PART II.

ON THE DISEASES OF BONES.

CHAPTER I.

PAGE
On lateral depression of the walls of the chest . . . 383

CHAPTER II.

On caries of the vertebral column; fistulous communications and symptomatic abscesses. General considerations on fistulas, and on the formation of a new tissue in their canals . . . 392

CHAPTER III.

On exostosis on the upper surface of the ungual phalanx of the great toe. Rare cases of exostosis . . . 408

CHAPTER IV.

On the more [illegible] spina ventosa, and [illegible] in bone . 416

CHAPTER V.

On the cysts which are developed in the structure of bones, and their various kinds [illegible]

Index [illegible]

INJURIES AND DISEASES OF BONES.

PART I.

ON THE INJURIES OF BONES.

CHAPTER I.

GENERAL CONSIDERATIONS ON FRACTURES.

Of the various branches of surgery with which the ancients were acquainted, that relating to fractures was unquestionably amongst the best known. It is sufficient, indeed, to turn to the pages of Hippocrates for confirmation of this statement. But if their precepts were often excellent, it is palpable that one important foundation was wanting,—a precise knowledge of anatomy. Setting out with the principle that it was necessary, at whatever sacrifice, to overcome the muscular action which displaced the fragments, they restored them to their natural relations, and employed mechanical resistance or permanent extension to counteract the tendency to subsequent disturbance.[1] Such, for many ages, was the course pursued by surgeons, who did not perceive that usually the constant tendency to displacement of the fractured extremities of a bone, and the powerful resistance of the muscles, were themselves the result of this very extension.

To William Sharp and Percival Pott belongs the honour of having established that the fundamental condition necessary to the reduction and maintenance of a fracture in a proper position is, that the muscles should be as much relaxed as possible. The advantages of this plan, which were probably exaggerated by Pott, though too lightly treated by Desault, were so evident, that it was speedily adopted and became popular in France, with the introduction of such important modifications as were deemed essential: and in the treatment of fractures of the lower extremity especially its superiority was recognized. The forced extension and apparatus of Desault were supplanted by the semiflexed position of the thigh and leg, maintained by an inclined plane: and in fractures of the leg, the limb was half bent on the thigh, either reposing on a simple pillow and lying on its outer side, or resting on its posterior aspect and supported on an elevated plane formed by several pillows.

---

[1] Hippocrates, Galen, and J. L. Petit referred briefly to the employment of semiflexion, but did not insist on its advantages.

It would be irrelevant to insist longer on this point of doctrine here, as its application will be sufficiently exemplified elsewhere: therefore we will pass on to a brief review of other divisions of the subject; and first, of the causes of fracture. A consideration of these is of great importance, for they give rise to very different effects, accordingly as they are direct or indirect. Again the age of the patient has an important bearing on the subject, inasmuch as the cure is rapid in youth, but proportionably tardy in old age. The bones of a child are softer, more vascular, possess more gelatin, and grow more rapidly; therefore their vital properties are more active, and reunion more quickly ensues. On the contrary, the bones of the old progressively lose their elasticity and suppleness; and from these causes, and the relative augmentation of phosphate of lime, they become more brittle. Atrophy of the osseous system, debility of the muscular system, diminution of the compact texture, and probably also, according to M. Velpeau, the presence of a large quantity of oily matter in the osseous tissue, contribute to explain this fragility of the bones in the aged, and their tardiness in reuniting. The above comparison of the extremes of youth and age lead to the natural conclusion, that the curative process in the adult will occupy a period intermediate between the two.

The signs of a solution of continuity, though palpable enough in a multitude of cases, often present difficulties which call for renewed investigation. On this point I have cleared up doubts, in the chapters "on fractures of the upper extremity of the humerus, and of the inferior extremity of the radius and fibula," which had so long been confounded with dislocations. For it must be borne in mind that pain, inability to move the part, and deformity of the joint and limb, are common to these two classes of lesion; and that crepitation and abnormal mobility are far from constant symptoms, owing to the thickness of the soft parts, or the shortness of the fragments.

The prognosis of fractures necessarily varies according to the locality, simple or complex nature of the injury, &c. Amongst the causes which retard or favour the consolidation of fractures, my attention has been especially directed to the following: the obliquity of the lesion, the scrofulous diathesis of the subject, the interposition of portions of muscle between the fractured extremities, certain diseases of the bones, and abnormal mobility of the fragments.

It is not enough to have formed your diagnosis in cases of fracture, to have pointed out the causes which may retard or accelerate reunion, and to have laid down the line of conduct adapted to each different form of complication, and the various circumstances which may attend the lesion; but the well-informed surgeon must not consider it an unnecessary condescension to occupy himself with cares which the vulgar consider too minute and unimportant, but which, if neglected and forgotten, so often entail the most disastrous results. Such, for instance, are the requisite precautions in stripping a patient, in moving him from place to place in such manner as to spare unnecessary suffering; the position in which he should be placed; the softness or hardness of the bed which he is to occupy during his cure; the mode of applying the dressings and any apparatus that may be required; the measures to be taken to ascertain the consolidation of the callus; and the advice to be addressed to the patient at this crisis—these are all points of which experience has proved the utility, and which will claim an especial share of our attention.

CAUSES OF FRACTURES.

Fractures may be produced either by force operating immediately upon the point at which it is received, or on parts more or less removed from it: hence the division into direct and indirect fractures, and those which result from *contre-coup*. Common blows and violence inflicted by fire-arms usually produce the first class, whereas the latter two are the consequence, in most instances, of falls more or less severe. But it is especially important that attention should be directed to the causes which give rise to one or other of these forms of fracture.

Direct fractures are accompanied by the variety of lesions which the same causes concur to produce in the soft parts as well as in the bones: such, for instance, is the case, where the accident results from the explosion of fire-arms, the kick of a horse, or from machinery, &c. &c. Indirect fractures, or those by *contre-coup*, frequently present two orders of phenomena, one of which has its seat at the spot where the force is applied, and the other where its operation has produced the fracture.

The influence of this agency is not, however, always apparent at the point from which the violence is propagated, as in fractures of the fibula which are referable to twisting of the foot inwards or outwards; but in fractures of the neck of the femur or of the clavicle, the hip or point of the shoulder frequently suffer from contusion; and, lastly, contused or lacerated wounds are very often found where the blow is inflicted, as by falls on the head, although the fracture may exist at an intermediate or directly opposite point.

The appearances which present themselves in the immediate neighbourhood of an indirect fracture consist of the various lesions which result from laceration of the soft textures, whether they be vascular, nervous, membranous, aponeurotic, or parenchymatous. These phenomena wholly depend on and are commensurate with the amount of displacement which the fragments of bone undergo, and the functions of the parts involved in the mischief. Thus, they are of little importance when the displacement is trivial, and the muscles alone suffer; but, on the contrary, when it is considerable, and such vital organs as the brain, lungs, or liver are implicated, the accident is proportionately momentous.

The manner in which the above causes operate to produce their several effects differs in the two species of fracture. In those which are direct the blow or force which tends to produce them, being applied immediately on the point where the solution of continuity is effected, breaks up the relation of the soft textures and bones with more or less violence, according to the momentum, volume and form of the offending agent;

and the consequence is laceration, division, fracture of the tissues subjected to its influence, or they may be detached, and even completely carried away from the integral mass. Of this class are those severe injuries, accompanied often by actual loss of substance, which result from severe blows, and especially from fire-arms.

Indirect fractures, and those by contre-coup, are one and all referable, however numerous and various their producing causes may appear, to an excess of flexion or extension, which tends to change the form of bones. Under the former and more common of these heads may be classed such accidents as fracture of the clavicle, from falling on the shoulder; and fracture of the cervix femoris is an example of the latter. Fracture of the ribs, again, offers an illustration in which one or other of the above causes may operate according to circumstances: thus, when pressure is applied in a direction from before backwards upon these bones, fracture results from excess of flexion or curvature; but if the force act laterally and on their centre, we have an instance of fracture occasioned by the tendency to make them straight. Almost all these fractures are oblique: and the obliquity is always dependent on the way in which the solution of continuity of the osseous fibres commenced. At all times the mode of transmission of the force from the points where it is applied to those where the fracture ensues, offers circumstances of a very varying character. In some instances the force is applied on the extremities of a bone, in others on some intermediate point. In the former case the bone yields, and ultimately gives way, being torn through in a direction from the convexity to the concavity of its bend; as in fracture of the ribs from antero-posterior compression of the chest: whereas, in the latter case, the bone is straightened until its fibres are forced, by the agency of the unnatural pressure, to yield from the concavity towards the convexity of its curve; as, in fracture of the ribs from lateral compression exercised on their centre. Under either of the above circumstances the fracture usually takes place where the bending or straightening of the bone is the greatest; but this is by no means invariably the case; for it is not unfrequently remarked that the bone yields at a point more or less removed from that at which the flexion or extension is greatest; and this disposition is apparent when the texture or tenuity of the part on which the force operates, renders it less flexible or more resisting than the surrounding parts, as, for instance, in the bones of the skull and the ilium.

However numerous and various the accidents which give rise to fractures, they may be referred to two principal heads: that in which the external violence is moderate, and confined to a limited space, the result being in such case less serious, and the character of the fracture simple and without wound; or that in which the force, volume, and rapidity of the agent is great, giving rise to fractures complicated with contusion or laceration of the soft parts, the bone itself being riven or splintered as the case may be. Such is the character of those solutions of continuity which are produced by the hoofs of animals which are shod, and especially of horses; the accidents which result from the last-mentioned cause at least equal, if they do not surpass, in importance the fractures occasioned by fire-arms.

Falls from a height constitute, without doubt, the most rife cause of fractures; but their danger does not bear a proportion to their frequency. When they occur, the foot having an inclination inwards or outwards, and the weight of the body being thrown upon it, there almost always ensues a fracture of the fibula, sometimes of both tibia and fibula, and more rarely of the tibia only. If the foot catch in any obstacle, and the body, in consequence, reel and fall forward, whether there be a muscular effort or not to keep the upper part of the body back, fracture of the patella usually results. Again, if the hand be extended as to protect the face in falling, the lower extremity of the radius, or perhaps both bones of the forearm suffer fracture. But if the body fall on one side the result may be a fracture of the bones of the leg or of the thigh, and especially of the cervix femoris, when the trochanter major is the part which first comes to the ground: in like manner the olecranon suffers when the elbow receives the weight, and the head of the humerus or the clavicle when the fall is on the shoulder. In backward falls the most common seat of fracture is the sacrum, or lumbar region of the spine; but the cervical region more commonly gives way when the individual is overthrown on the steps of a ladder.

When the body falls from any great height, or is struck by heavy weights falling on it, the consequences are by no means limited to simple, compound, or even comminuted fractures; but these causes frequently give rise to those crushing forms of accident which involve the limbs, trunk, face, chest, and pelvis, together with the organs they inclose in one confused mass of broken bones, bruised and torn flesh, and extravasated blood, together with such disorder of functions as precludes the possibility of the sufferer surviving more than a few hours, or at most a few days.

Amongst the causes of fractures there are some which are of a purely accidental character, such as season, professions, and sex. There can be no doubt that, other things operating equally, the number of fractures is greater in winter than at other seasons of the year, apparently on account of the slippery state of the ground, occasioned by frost, which must tend to increase the number and severity of falls. The results obtained from hospital statistics inform us that the occupations of carpenter, house painter, mason, carrier, and coachman, which oblige those who follow them to work on scaffolding and to move heavy weights, are much more productive of fractures of all sorts than sedentary employments. We also learn from the same source that, in spite of the numerical superiority of women in the population (?), that sex furnishes by far the smaller proportion of fractures to the hospitals. This difference fluctuates between one third and a half, and may be readily accounted for by the difference of habits and occupations.

ON THE TREATMENT OF FRACTURES.

It has been already remarked that no precaution is to be neglected in the treatment of disease; one single omission may be followed by most disastrous results. Thus, for instance, the manner in which patients are lifted up after falls, attended by fracture, is generally careless and slovenly. The sufferers themselves, prompted by an ill-timed courage, or from ignorance of their condition, thoughtlessly attempt to move or rise, and forthwith again fall. These efforts are a very common cause of the accidents consequent on fractures; the primary fall producing a simple fracture, and the second occasioning displacement, laceration, and other serious complications, such as we often see following falls on the hip, where attempts are made such as those above alluded to. Every patient who has had a severe fall, and fears that he has broken a leg, should, if circumstances do not forbid it, remain quietly in the position which is least painful to him, until assistance is afforded. The same remark applies where fracture of the spine is suspected; but the course recommended may, for obvious reasons, be deviated from when the upper extremity is the exclusive seat of injury; and even in fracture of the bones of the trunk, slight movements are admissible, if requisite, and are not attended by the evil consequences which accompany like efforts in the looser fractures.

A few observations addressed to non-professional persons, if called on to render assistance in a case of fracture, may not be deemed irrelevant. A praiseworthy desire to be of some service prompts most persons to take an active part in attempting to remedy the mischief which, by such ill-directed efforts, is sure to be grievously aggravated: whereas, a man of the world, who has sufficient sense to be conscious of his own insufficiency, will feel that the kindest course he can adopt, is to protect the sufferer from the officious services of those about him, to place him in the most comfortable position, and send, not for the nearest but, for the most intelligent surgeon, as so much depends on the first steps which are taken to ward off the probable mischief which may follow. When the surgeon has ascertained the existence of a fracture, his first care should be, where the swelling is considerable, to rip up the clothes which may produce strangulation; where the displacement is great, to remedy it on the spot, and employ such temporary measures as are at the time available; and lastly, to devise the best means for removing the patient to his home, in which he must be guided by the circumstances of the case. A litter is probably the most easy mode of carriage for the patient, and this may generally be constructed in a rough way with pieces of wood of proper strength and thickness, and then covered with hay or straw; but if the opportunity of procuring a litter especially appropriated to these purposes is afforded, it is scarcely necessary to add that it should be preferred. When a carriage is requisite, as the only means of transport which can be procured, it should be hung on good springs, or at the least its bed should be well covered with straw, and provided, if possible, with a mattress and pillows. The patient should then be lifted with the greatest care on to the litter or carriage, one assistant having charge of the injured limb, and placing it in a semiflexed position: it is desirable also that an intelligent person should accompany the patient, and render all necessary assistance which can tend to mitigate suffering in such a case. In the course of the journey it will be requisite to pay attention to details which involve the comfort of the patient,—such as resting at intervals, avoiding narrow or crowded thoroughfares, affording some simple beverage to quench his thirst, and scrupulously withholding any food or drink of a stimulating character, under the pretext of supporting the strength of the patient. The most appropriate form of bed for fracture cases is narrow, moderately low, without foot-board, and supplied with a mattress; and pillows should be placed so as to support the head and shoulders of the patient. Further, where the choice is afforded, a position which commands an agreeable view should be selected, as tending to relieve the tedium of a long confinement, and withdraw the patient's thoughts from himself; and the bed should be so placed as to allow of the surgeon's passing to either side at will. All these points should be attended to before the patient is removed from the carriage or litter. Then comes the preparatory step of undressing the sufferer, and as this is generally an operation attended by great suffering, it should be superintended, and indeed performed, by the surgeon himself. Even the uninjured limbs should be stripped with caution, and much more should tenderness be shown in removing the clothes from the fractured member: no attempt should be made to save these, but they should, in every case, be ripped up or cut away from top to bottom. The parts about the injury should then be carefully cleansed and the hair removed, and the patient's usual night-dress put on, before the final examination is made, in order to determine the seat of fracture. In conducting this examination, the surgeon may avail himself of the account of the accident, and such other information as the patient or the bystanders can afford: yet he must not rest satisfied with this, but ascertain for himself, by employing every means at his command, the exact nature and position of the injury; this is the only way to avoid serious errors in diagnosis, and consequently in treatment.

(A case in point is here cited by M. Dupuytren's editors, as illustrating the importance of not trusting the accounts of others. A young lady had thrown herself from a window, and the medical men who were first called in believed that the case was one of fractured cervix femoris, and accordingly applied the usual apparatus employed at the Hôtel-Dieu. M. Dupuytren was then summoned, and being informed of the nature of the accident, approved of the treatment and left. At the expiration of three months, when he removed the apparatus which surrounded the limb, he discovered a dislocation of the femur upwards and outwards.)

The examination being completed, the surgeon is called upon to apply the necessary dressing, splints, &c. The latter it is desirable he should carry with him, when called to the patient, if he can at all judge of what he is likely to require, otherwise he will take measures to ascertain what will be requisite, and have it prepared accordingly. In the application of the necessary apparatus, one intelligent assistant is all the surgeon needs; and then the patient being placed in a suitable position on the bed, the proper steps are to be taken to reduce the fracture.[1]

ON THE REDUCTION OF FRACTURES.

This operation is unquestionably the most important and troublesome in the treatment of fractures, and presents much greater difficulties than the reduction of dislocations. In the latter, the restoration of parts to their normal condition is an unerring guide to the amount of force it is requisite to employ; and the evidence of the signs which announce that the dislocation is or is not reduced, may be regarded as unequivocal in this respect. Not so with fractures: in the first place we do not know how much extension may be called for, as this varies according to numberless circumstances which it is impossible to foresee. It is impracticable to ascertain precisely whether the fractured extremities of the bone are in accurate apposition, as the surrounding muscles in almost all instances mask the condition of the hard parts from the eye as well as from the touch. Lastly, there is usually no medium, in dislocations, between entire displacement and complete reduction; whereas, in fractures, there are a great many intermediate conditions, which may deceive even the most experienced with the impression that reduction is perfectly accomplished; and this is why both patient and surgeon are so often and grievously disappointed, when the apparatus is finally removed, although it may have been most appropriately selected and most carefully applied.

---

[1] [The observations contained in the two or three preceding pages are materially abridged from the original, in which the detailed directions are tediously minute.—Tr.]

In order to obviate these painful results, it is desirable to seek for some simple means of diminishing the resisting power rather than to employ great violence in overcoming it. It cannot be too often repeated that the sole cause of displacement and resistance is attributable to the spasm of the surrounding muscles, whether the case be one of luxation or fracture; and their painful and constrained position renders them susceptible of the least movement or attempt at reduction.[1] It is, therefore, particularly important that they should be treated in a way to prevent their contraction, or, at the least, to diminish its effects. The best mode of fulfilling this indication is to place the limb in a position of semiflexion or a quarter flexed, —a point which cannot be too strongly insisted on. Every careful observer of the conditions which favour and oppose the reduction of fractures, must soon feel convinced that the tension of the muscles, which invariably accompanies extension of the limbs, constitutes the greatest obstacle to the reduction of fractures; that the relaxation of the muscles, such as is produced by semiflexion, is most favorable to reduction, and is, therefore, the position to be preferred, in order to effect reduction with the least possible violence. The first attempt will not always succeed, as fear and pain will, under the most favorable circumstances, produce involuntary opposition on the part of the patient, who should be soothed and encouraged, in order that the serious consequences of these muscular spasms may be avoided. Thus, the surgeon may avail himself of the various little artifices of which he is master,—such as familiar chat, earnest questions, lively exclamations, or feigned complaints; and by these means he may succeed in distracting the attention of the patient, and in accomplishing the reduction. The aid of two assistants is required at this period, one to make counter-extension above, and the other, simple extension below: each must grasp that part of the limb which is trusted to him firmly with both hands, and whilst the one fixes the upper part, and the other extends the lower, it is the business of the surgeon, by careful manipulation, to adjust the fractured extremities of the bone until they are in accurate contact.

---

[1] The reader need scarcely be reminded of the superadded influence of atmospheric pressure in dislocation, as pointed out by Weber.

The object of counter-extension is the same in fractures as in dislocations, viz. to fix one part of the bone, of the limb, or of the trunk, as the case may be. There are two rules which must not be deviated from in making counter-extension; the one is to keep that portion of the limb which is fixed, at right angles with that which is fractured, and the other is to maintain it perfectly immovable during the process of reduction. If these rules are not attended to, the limb will be found to pass gradually from a state of flexion to that of extension, and the muscles from a relaxed to a tense condition, by which the obstacles to reduction will be greatly multiplied, in consequence of the alternating predominance of the extension and counter-extension; and a struggle will ensue, which must result in spasmodic contraction of the fatigued and irritated muscles, and in their ultimate triumph over the combined efforts of the surgeon and his assistants.

Extension is the agency by which a fragment, or the whole of a displaced bone is brought into its normal position; and this requires more intelligence for its effectual application than counter-extension. The assistant thus employed should be careful to steady himself, so as to execute what is required of him to the best advantage; he is then to grasp that part of the limb which is below the fracture, and pay prompt attention to the directions of the surgeon—relaxing his efforts, suspending or augmenting the extension, as circumstances may require. Moreover, in almost every case, these efforts must be graduated and slow; if they are executed violently, and by fits and starts, pain and resistance on the part of the muscles will follow, by which, in one moment, much that has been previously accomplished may be entirely negatived. It is not with fractures as with dislocations; in the latter sudden and unexpected extension can do no harm; if reduction is effected the muscular reaction can be of no avail in reproducing displacement; or should this object not be obtained, the condition of things is no worse than it was before. But with fractures, on the contrary, any sudden violence is sure to be attended with mischief, whatever its effect on the relation of the fractured extremities of a bone; for it must be borne in mind that the solution of continuity (itself the passive cause of the displacement) still exists, albeit reduction has been effected; and that the muscles, if irritated, are ever ready to take advantage of the tendency on the part of the fracture to yield.

The adjustment of a fracture is the operation by which the separated extremities of a broken bone are placed in accurate contact, and is only applicable where these extremities ride; it cannot, therefore, be employed with any advantage, nor indeed without injury, until the fractured ends are brought parallel by the means already described; and then it commonly results from the employment of these very means, without the active interference of the surgeon, whose sole duty in such case is to watch over and direct his assistants. If, however, this should not be the case, it will be necessary for him to press with his expanded hands the most prominent parts of the displaced fragments, to push them towards each other until their extremities are in contact; and he is generally informed that this desirable object has been obtained by the grating noise which is heard when the fractured ends meet. The adjustment of transverse fractures is simple and comparatively easy; but that of oblique fractures is troublesome, on account of the facility with which the separated extremities of the bone glide over each other, not having the same points of rest or mutual support which the surfaces of a transverse fracture present. The surgeon must therefore expect to be frequently foiled in some cases before he succeeds in reducing an oblique fracture, and must mainly trust to the aid of appropriate apparatus and a suitable position of the injured limb.

ON POSITION.

Of all the measures employed for maintaining perfect repose in the fractured parts, for obviating stretching of the ligaments, and preventing irritation and contraction of the muscles, which is the most frequent cause of displacement of the fragments, no one is more efficacious than position. In short, by placing the injured parts in the most natural position, and combining with this the relaxation of the muscles, two important ends are attained—repose, which is so necessary for the patient, and a quiescent state of the muscles of the limb. As long as the bones are left to themselves they remain passively in the position in which they are placed; but, unfortunately, they are subject to the influence of agents both within and without the body, of which muscular contraction is by far the most important. This may be excited in a variety of ways,—by pain, spasm, delirium, dreams, &c., or it may be voluntary. But be the cause what it may this is certain, that these contractions are most frequent and mischievous when the muscles are stretched and irritated; but when they are relaxed, and their attachments are as much as possible approximated, nearly all tendency to contraction is subdued, and the effect of such as may take place is almost negatived. It is true that this principle may be abused, and that extreme flexion of the limb will involve tension of the extensor muscles, and thus mar the proposed end. This is not unfrequently witnessed in fractures of the leg, where flexion is carried too far; the extensor muscles being put upon the stretch produce displacement of the upper extremity of the fractured tibia forwards. It is by the semiflexed position of the limb, and by that alone, that the muscles, one and all, are suitably and sufficiently relaxed; and this, in consequence, is the position to be preferred, except in such cases as present some peculiarity in the form or position of the fracture, which may call for appropriate modifications in the treatment. The point, therefore, to decide on is, the most favorable position for procuring this general relaxation of the muscles, at the same time that we include in the consideration those measures which are best adapted to prevent subsequent disturbance of the injured limb.

An attentive observation of that position which is natural to a limb in a state of perfect repose, together with its effects on fractures, will very soon teach us how to apply the general directions which have just been given. As regards the means at our command for maintaining the position we may have selected, they vary according to the nature of the accident; but it is easy to understand that they must consist in giving such support to the parts as may preserve their proper relation without fatigue, and even present, in case of need, an opposing force to movements which may result from spasm or inadvertency on the part of the patient, or such as may occur during sleep. Nearly all these ends are attained by the use of simple pillows, cushions, and mattresses, which yield and preserve, without trouble, the necessary forms; advantages which cannot be too highly appreciated, on account of the facility with which these articles may be at all times and in all places procured.

APPARATUS FOR FRACTURES OF THE EXTREMITIES.

As it is intended to exclude details from the present division of the subject, a cursory review of the principal forms of apparatus applicable to fractures of the extremities is all that will be at present attempted.

In all cases of simple fracture of the upper extremities, unaccompanied by wound, the common rolled bandage is to be preferred. Some compresses are to be placed across the limb, as high as the seat of fracture, and over them splints of steel, cardboard, or wood. When the fracture is in the humerus the patient is made to sit down, and one, two, or three compresses are applied;[1] after which pads are placed on the four surfaces of the limb, and over them the splints, care being taken that the articular processes of bone be not pressed upon; this is then preserved in position by a bandage. In cases of fracture of the forearm the requisite materials are a roller four or five ells long, some pads, and two splints of the length of the forearm, or even a little longer, and always somewhat wider; lastly, an iron splint bent outwards. The patient being seated, one assistant grasps the fingers with his hand, whilst another fixes the lower part of the upper arm (the limb being slightly flexed at the elbow), and then extension is to be commenced. The surgeon, by carefully managed pressure on the front and back of the forearm, squeezes the muscles into the interosseous space, by which the fractured extremities of the radius are separated from those of the ulna, and their natural relation restored; the next step is to roll the hand as far as the wrist, and the remainder of the bandage is given to an assistant to hold; pads of sufficient width, and dipped in vegeto-mineral water, are then applied on the dorsal and palmar surface of the arm, and should be made to cover the wrist, carpus, metacarpus, and condyles of the humerus. The two splints being next placed over these, the surgeon resumes the roller, and carries it up from the wrist to the elbow. By this course the antero-posterior diameter of the arm is increased, and the interosseous space, which is so essential to the rotatory movements of the forearm, is preserved. Where fracture of the forearm is complicated by a wound, other appropriate forms of apparatus must be employed.[1]

---

[1] [These compresses are rarely required, and often mischievous.—Tr.]

In fractures of the radius an additional splint is to be applied on the ulnar side of the forearm, consisting of an iron plate, bent at its lower extremity, and having several studs in its concavity. Between the inner border of the wrist and the convexity of this splint, a pad, several times doubled, is applied, in order to separate them (the splint and wrist) from each other; the hand is then drawn towards the splint by binding the radial border of the former, together with a cushion placed between the thumb and base of the index-finger, to the curved splint; this is effected by means of tapes, which pass from either extremity of the pad to the studs on the iron splint.

Where the olecranon is fractured a pad above this process is alone required, and a straight anterior splint is also to be employed.[2] In cases of fracture of the leg or thigh the many-tailed bandage is preferable to the common roller. The limb is to be supported by pillows, which at once maintain its position and prevent congestion. A sheet several times folded should be placed over the pillows for purposes of cleanliness; this is especially necessary in hospital practice, as they are otherwise soaked with blood and pus, and become the nidus of infection. On the sheets are laid all the straps which are required for fixing the different parts of the apparatus; of these three are required for the thigh, and the like number for the leg—six in all. The under or cradle sheet should be doubled, and as wide as the thigh or leg (as the case may be) is long; it is to be placed across the straps, in readiness to receive the splints. Over this the divided roller or tailed bandage is to be placed; the former is preferable where there is a wound, and consequent draining of pus or blood, because each division may be separately removed as required; and this is easily effected by pinning a fresh bandage to the end of that to be removed, and then withdrawing the latter. But where there is no wound a many-tailed bandage answers the purpose better, the application of it commencing at the lower part, and proceeding upwards. These tails should be sufficiently long to pass nearly twice round the limb, and their number must be determined by circumstances.

---

[1] [It has been considered unnecessary in this, as in other places, to particularize inventions which are unknown in England, unless a description of them accompanies the name of the inventor.—Tr.]

[2] [In this country a slightly flexed position is considered preferable; it answers every purpose, without being so painfully fatiguing as the straight position.—Tr.]

The cross pads should be as wide as the roller, adapted according to the projection of the fracture, and removable at pleasure. In some instances the application of cardboard, or light wooden splints, with the interposition of one or two simple pads only, will be found preferable, as acting more directly upon the extremities of the fracture.

Everything being prepared, the bandages are first applied over the pads; then the splints are wrapped on either side in the cradle sheet, and properly padded, according to the form of the limb; and lastly, the whole apparatus is bound together by the straps, which are made fast over the outer splint. A foot-piece and appropriate straps serve to keep the foot in one position; a cradle preserves the parts from the pressure of the bedclothes, and a sheet rolled round the limb, and fastened to both sides of the bedstead, prevents motion. Great reliance is to be placed on this last precaution, especially in fractures of the upper part or neck of the femur.

Where the fracture is simple and without wound, it is still requisite, the day after its application, to raise the apparatus and examine the limb; as in some instances great swelling and even gangrene have been known to supervene in four and twenty hours. Afterwards, if there is no pain, a visit every five or six days will suffice. As to the period of treatment, in general it will be requisite to keep on the apparatus twenty-eight or thirty days in infants, forty days in adults, and a much longer time in old people: it should not be removed until the union appears to be complete. The best mode of ascertaining this fact is to grasp the fractured bone above and below the seat of injury, and move it cautiously in different directions; if there is any yielding in the callus, the apparatus should be reapplied immediately, but if the union appears firm, it may be left relaxed by the side of the limb for a few days. At this crisis, however, it will be necessary to forbid the patient to walk, as the weight of the body and action of the muscles may cause the callus to give way; he should, on the contrary, keep in bed and at perfect rest for ten days or a fortnight, and then he may sit up, resting his foot on a pillow, with the limb rolled, for about three weeks longer; at the expiration of which time he may commence the use of crutches, walking on smooth ground, and being very cautious that he does not slip.[1]

---

[1] [The preceding remarks on the treatment of fractures of the lower extremity have been somewhat curtailed, for reasons which will be obvious to those who are familiar with the treatment of fractures in our hospitals, where the same ends are, for the most part, attained by simpler and more efficacious means than the rather cumbrous apparatus of the surgeon of the Hôtel-Dieu.—Tr.]

CHAPTER II.

ON SEVERAL CAUSES WHICH MAY TEND TO HASTEN OR RETARD THE CONSOLIDATION OF FRACTURES.

WHATEVER care may be taken in the reduction of fractures, and in the selection of means for preserving position, it will nevertheless occur occasionally that union is protracted beyond the usual period. This tendency is owing to circumstances, many of which have been either altogether overlooked, or their importance has not been properly appreciated; such as the oblique direction of the fracture, the interposition of muscular fibres between the fractured ends, the presence of hydatids in the bones, a scrofulous or rickety diathesis in the patient, &c.

ON THE OBLIQUE DIRECTION OF FRACTURES.

Authors who have written on the diseases of bones have divided fractures into transverse, oblique, double, and comminuted; and they have nearly all adopted these conventional distinctions, without tracing or even perceiving the effects and consequences of varieties at least equally great and important. A reference to works on the subject will prove that these remarks are entirely applicable to the phenomena and treatment of oblique fractures.[1] Nevertheless, it cannot be denied that these considerations are of weighty importance; especially as the statistics of the Hôtel-Dieu prove that one half, or nearly that proportion of the total number of fractures admitted into its wards are oblique; but the extent and direction of the obliquity are by no means identical in all cases; on the contrary, the variations in these respects are infinite, and one may easily conceive that, for their successful treatment, the theory of these fractures ought to be clearly understood.

---

[1] [The author, of course, refers to the works of his countrymen.—TR.]

An oblique fracture may be defined as a complete solution of continuity, which deviates in direction from the longitudinal axis of the fractured bone. The varying amount of this obliquity may be measured, by taking the distance from the highest point of the fracture to its lowest or terminating extremity. I have ascertained, by frequent examination of the bodies of those who have fallen victims to accidents, that in the femur the obliquity in question varies from an inch or an inch and a half, even up to three inches; and the obliquity measured on the *dead body* may be pretty accurately calculated on the *living*, by the aid of sight and tact, or the phenomena attendant on fracture, such as pain, displacement, the prominence or riding of the fractured ends, the difficulty experienced in reducing them, and, above all, the trouble of preserving them in proper relation when they are reduced.

When a bone is fractured transversely, displacement readily occurs in a horizontal direction but not longitudinally: in these cases, unless the fractured ends completely overlap, there is no shortening; the opposing muscles acting on either extremity of the bone antagonise each other, and their efforts to produce displacement are negatived by the point of rest or resistancc which the two portions of the fractured bone mutually afford to each other at the seat of fracture. Even should the ends of the bone originally overlap each other, when once placed in apposition, very slight force is sufficient to retain them so; and the *provisional callus*[1] formed at the expiration of forty days is of sufficient consistence to prevent any risk of their subsequent displacement. But in oblique fractures, the longitudinal displacement or shortening easily takes place, and is renewed with a pertinacity proportioned to the amount of obliquity; whereas, the horizontal deviation is almost always trivial and unimportant. If it be asked why this minute distinction between oblique and transverse fractures is made, the answer is this: not only is there a natural tendency on the part of the muscles to produce, by their contraction, the displacement of the fractured extremities of a bone, which are incapable by themselves of retaining their proper relative position, but this very displacement reacts, as it were, and greatly increases the mischief, in consequence of the muscular spasm produced by the contact of the irritating fragments of bone; hence arises the multiplication of causes and effects, and hence the danger of those cases in which the fractured end of a bone is so often seen to work its way through the soft parts and protrude; thus converting a simple into a compound fracture.

---

[1] [The definition and proper limitation of this word will be found in the next chapter.—Tr.]

These solutions of continuity are not only difficult to reduce, but there is almost as much trouble in keeping them in position: you may, in fact, succeed in reducing and placing the fractured ends in the best relation possible, and may further apply the ordinary apparatus in the most exact and methodical manner, yet the slightest movement of the patient or spasm of the muscles will undo all that has been done; and at the end of twenty-four hours you will find your patient in a worse condition than immediately after the occurrence of the accident. It is in such cases as these that the method recommended by Pott possesses such superior advantages, although he has not sought himself to justify the plan of treatment he introduced by any reason so conclusive as that of which we have just spoken, and which springs as a necessary consequence from the theory regarding the obliquity of fractures, which has just been propounded.

Fractures of the cervix femoris belong to the class of oblique fractures, which is doubtless the reason why they are so difficult to reduce and maintain in position, as well as to cure without shortening. In one sense or other, it may be said that these fractures are always oblique, even when they are exactly perpendicular to the axis of the bone; for, when we call to mind the position of the neck of the femur in the relation it bears to the axis of the body, and to the muscles which pass from the pelvis to the thigh, it becomes evident that, in all cases, the weight of the body must have the effect of depressing the superior fragment inwards, whilst the muscles tend to draw the shaft of the bone upwards. The consecutive deformity, which is so often witnessed in these cases, is further referable to this obliquity, and will be found almost always to occur in cases where the apparatus is removed, or the patient is allowed to walk at the end of forty, fifty, or even sixty days; indeed, so frequent are these secondary displacements, that many practitioners have affirmed that these fractures are not susceptible of union.[1] But if these surgeons had adopted the practice of the Hôtel-Dieu, in keeping their patients in bed for eighty or even a hundred days, they would have been convinced of the practicability of reunion and complete cure without deformity. Within a few months of the period at which this is written, five or six cases have occurred within the hospital which confirm this assertion; and especially one of an old woman, seventy years of age, who was admitted with a palpable fracture of the neck of the thigh-bone, and who recovered perfectly after eighty days of confinement, without either obliquity or shortening.

Besides the varieties in oblique fractures which relate to their extent, there are others which have reference to the mode in which they may occur. Thus, eight different sorts of obliquity may be recognized, as oblique fracture may take place in four several ways, accordingly as the bone is bent forwards, backwards, inwards, or outwards; and in each of these varieties, the direction of the obliquity may be from below upwards or from above downwards. It is true that oblique fracture extending from above downwards and backwards, is in reality the same with that which is directed from below upwards and forwards; nevertheless, as the effects on the surrounding soft parts in these different cases may vary, although the actual condition of the bone is the same, the distinction in question is not without its advantages. Take, for example, a fracture of the shaft of the femur, which is directed obliquely from before, backwards and upwards; it is evident that the upper part of the bone will project forwards, and the lower portion will penetrate the soft parts at the back: whereas, the converse is the case, when the direction of the fracture is from above, downwards and backwards.

Here a series of questions of varying importance present themselves for our notice; and, first of all, what is it that occasions the overlapping of the ends of an oblique fracture? Very often it is the violence which causes the fracture; in some instances it is the superincumbent weight of the body; but most frequently it is the contraction of the muscles which are attached to the two extremities of the broken bone, or may be a neighbouring bone, and which have an unremitting tendency to produce riding of the fractured ends. It is on this principle that the paramount importance of procuring entire relaxation of the muscles is insisted on; and this can only be ensured by such position as shall bring nearer together their opposite extremities. But, it may be naturally asked, which are the muscles that determine the displacement or overlapping of this or that fragment? And here the practical value of the preceding remarks becomes apparent, and clears them at once from the imputation of constituting a mere idle distinction. Suppose the fracture to extend obliquely from before backwards, whether it be from above downwards or from below upwards, it is clear that displacement can only be produced by the flexors and extensors: if, on the contrary, the direction of the fracture be obliquely from without inwards, or the reverse, the displacement will be caused by the adductor and abductor muscles; in the latter case the flexors and extensors have no share in the production of this effect, save under a very aggravated state of tension.

---

[1] [Though this scepticism has now pretty generally yielded to the accumulated evidence on the subject, there is no doubt that bony union of a fracture within the capsule is of comparatively rare occurrence.—Tr.]

In general one is led to believe that, in cases of the sort alluded to, the overlapping extremity of the bone is displaced by the contraction of the muscles which are attached or peculiar to it, and that therefore it is on these muscles we must especially act. This opinion is founded on error; as it is often the muscles that are attached to the opposite extremity of the bone which produce the mischief, and towards which it is, consequently, necessary to direct all our attention. Thus, for instance, when there is riding and projection of the upper part of the shaft of the femur, following oblique fracture upwards and backwards, it is not the muscles attached to this division of the bone which produce the deformity, but rather those which are connected to the inferior half, or even to the bones of the leg, whether they be flexors or extensors; they operate by pressing or driving forwards the upper portion of the fractured bone, which is, in this way, made to bury itself in the soft parts, by the intermediate agency of the lower portion, which is forcibly drawn upwards, and forwards or backwards, as the case may be, by the respective muscles.

The theory of the above displacements is not only intimately associated with the principles which have been just laid down, but the principles themselves have an important bearing on the treatment, effects, and consequences of these fractures. When the apparatus employed for a transverse fracture is removed at the expiration of thirty or forty days, the provisional callus is sufficiently strong to resist the action of the muscles and the weight of the body, and will not be found to yield, unless from undue pressure exercised on the newly-formed structure by an uneven gait or false step, or by a violent fall.

This desirable result is not obtained in oblique fractures, even when they are carefully reduced, and the fractured extremities are preserved in accurate apposition: the removal of the apparatus at the same period, that is, after the lapse of forty days, is almost certain to be followed by consecutive shortening, which requires neither fall nor false step, nor unusual muscular efforts to produce it; on the contrary, the effect is slow and progressive, and apparently referable to the insensible (tonic) contraction of the muscles. Such a marked contrast in the two classes of injury above cited naturally calls for an explanation, and this is satisfactorily afforded by the difference which exists in the direction of the fracture. In the one case (that of transverse fracture) the two extremities of the bone sustain each other, and whilst they thus negative the action of the muscles on themselves, they at the same time support the provisional callus: whereas in oblique fracture, the surface represented by the contact of the broken ends of the bone is that of an inclined plane, which is wholly incompetent to resist the tendency of the muscular contraction to produce displacement, and for the same reason is incapable of affording any support to the provisional callus. The consequence is that the latter, being too weak to maintain its newly acquired relations at such disadvantage, yields, permits displacement of the adjoining surfaces of the fracture, and riding or overlapping is the consequence. To this cause may be traced the various results of suffering to patients, shortening and deformity of limbs, non-union and false joints, which are so often the sequences of this class of fractures.

We may dismiss this subject with the following practical deduction,—that the duration of the treatment of oblique fractures ought to extend over a term twice the length of that which is required for transverse fractures. In brief, although the provisional callus may prove sufficient to resist muscular action in transverse fractures, nothing short of the permanent (*définitif*) callus will be found capable of counterbalancing this powerful agent in oblique fractures; and three, four, or even five months must be allowed to elapse before the provisional is replaced by the permanent callus. It is on these grounds that I have, for a long time past, kept under treatment fractures of the cervix femoris and patella, for four or five months, and ordinary oblique fractures for three months; and to this cause the success which has attended my practice may be justly attributed.

Case I. *Oblique fracture of the lower extremity of the left leg.*—J. P. Badin, aged 30, of sanguineous temperament, strong constitution, and good health, was knocked down by a carriage, which passed over his left leg. When brought to the Hôtel-Dieu the following condition was ascertained: there was considerable shortening of the limb, with deformity and abnormal mobility about three inches above the tibio-tarsal articulation; opposite the same point was a wound, about a finger's breadth in size, which communicated with the fracture. There had been some oozing of blood, but the swelling was trifling, though the pain was great. Crepitation was distinct, as was also the oblique direction of the fracture, the lower extremity of the bone being forcibly drawn upwards and behind the superior portion. The wound was dressed, and the limb placed in a semiflexed position, supported by the usual apparatus, which sufficed to restore the natural form of the limb. On the first day a strict diet was prescribed, and blood was abstracted three times; this operation was twice repeated on the second day, and once on the third and fourth, when the diet was a little improved.[1] On the eighth day the swelling had entirely subsided, and the extravasated blood was absorbed; and on the twenty-fifth the wound was healed and the provisional callus formed. On the thirty-fifth day there was no longer any unnatural mobility, and in ten days more the apparatus was thrown aside, but the patient was not allowed to walk until the sixty-fifth day. On the seventy-seventh day after the receipt of the injury, this patient left the hospital perfectly well: there was no deformity, the union was solid, and it was difficult to detect the traces of the callus by which the fracture was united.

---

[1] [Bloodletting is very rarely called for in these cases, at any rate in London practice. The amount of blood taken each time in this instance is not mentioned in the text; but it is to be presumed that it was not very large.—Tr.]

Case II. *Very oblique fracture of the right tibia in its lower third, accompanied by laceration of skin, &c.*—C. V. Ferez, a butcher, fell over a ladder when he was tipsy, and was brought to the Hôtel-Dieu, June 29, 1820. The deformity of the limb, the projection of the spine of the tibia, or rather the prominence of the skin opposite this projection, were, at first sight, sufficient indications of fracture of this bone. The position of the fracture was in the lower third of the leg, and its direction obliquely downwards and inwards; the upper extremity of the bone pressing upon the integument, which was raised and lacerated to a small extent, and through the opening thus made there was some oozing of blood: independently of this there was considerable extravasation and infiltration beneath the skin. The limb was placed on two pillows, and put up in the usual apparatus, care being taken to place a pad on either side of the tibia, for the purpose of keeping in position the upper part of the bone, the pointed extremity of which was otherwise disposed to project; the small wound was thus also covered. The patient was then bled, and a strict diet prescribed. In two or three days no trace of swelling in the leg or foot was perceptible, nor was there any symptom of deep-seated inflammation: nevertheless, the severe nature of the injury was such as to engender fears respecting the result of the case. On the fourth day the wound was nearly healed, in spite of the pressure of the bone to which the compresses were kept applied; and on the twelfth it was entirely healed. On the twenty-seventh day union had commenced, though, from the extreme obliquity of the fracture and consequent tendency to overlap which existed, there was some slight riding of the extremities. On the forty-fifth day the apparatus was removed, and the patient soon afterwards began to walk, and ultimately left the hospital well, and with only slight deformity at the seat of fracture.

Case III. *Oblique fracture of the leg; projection of the upper end of the bone.*—Leclerc, aged 30, a locksmith, was admitted into the Hôtel-Dieu, May 15, 1832. He fell from a height, and broke his right leg a little below its centre, the direction of the fracture being obliquely downwards and outwards, so that the upper portion of the bone overlapped the lower, and threatened projection outwards. The usual apparatus was employed, and the limb laid on its outer side, the patient being likewise directed to lie on the right side. This advice was not scrupulously attended to, and the consequence was that on removing the apparatus, after the lapse of a sufficient period, the callus was found to be solid but faulty (vicieux): the upper extremity of the bone was very much twisted outwards, and could be felt projecting for several lines beneath the skin.

The plan of placing the limb on its outer side is in general good, but it is sometimes attended with considerable drawbacks. When patients, for some reason or other, do not preserve this position, the knee is raised, and the consequence is that the upper fragment of the bone is depressed at its extremity; for the weight of the body is unequally thrown on the part in question, tending to produce ulceration of the skin, in addition to the deformity of the bone. It would not, however, be just to say that the above inconvenience is inseparable from the method; for if the patient strictly adheres to the position enjoined, there is no reason why displacement should ensue, as the muscles are relaxed by the semiflexion of the limb, which is equally sustained along the whole extent of its outer side.

The same accidental result as that above narrated was observed in another patient, in whom it had been found necessary to tie the femoral artery for wound of the tibial: the fracture united, but with overlapping and prominence of the upper fragment of bone. From these and many other cases I have been led to deduce a new and important principle in the treatment of oblique fractures of the leg, which is this: when the obliquity is lateral, the limb should be placed on its posterior aspect, in a semiflexed posture; but when the direction of the obliquity is from before backwards, or the reverse, the position in which the limb lies on its outer side should be selected.

ON THE INFLUENCE OF SCROFULA, RICKETS, AND CANCER.

Although the bones of infants are in general less subject to fractures than those of adults, and more especially than those of old people; although, moreover, they unite more speedily, which few can have failed to observe, there are, nevertheless, some cases which constitute exceptions to this general rule, and which appear to owe their peculiarity to something in the constitution of the patients. Thus, it may be often remarked that a scrofulous, rickety, or cancerous diathesis may suffice to present obstacles to the consolidation of fractures.

CASE I. *Fracture of the left thigh in a child of a scrofulous diathesis, cured at the expiration of four months.*—A little girl, 2½ years old, was brought to the Hôtel-Dieu with an injury to the thigh. She had, amongst other evidences of a scrofulous constitution, some curvature of the long bones, and enlargement of their articulating extremities. It appears that, some time previously, she had broken one of her arms by falling out of bed, and that for this injury it had been found necessary to keep on the splints for two months. She had, this time, fallen from a go-cart, with the thigh bent up under the body, and when brought to the hospital the usual symptoms of fracture were readily recognized. An antiscrofulous regimen was prescribed, and the thigh was put up in the usual way, every necessary precaution being taken to ensure a successful result; still, at the end of thirty-six days, shortening, crepitation, and abnormal mobility proclaimed that there was as yet no union of the fracture. The apparatus being replaced, another month was allowed to elapse, but at the expiration of this second period the same unfortunate condition again presented itself: and it was not until after six weeks' further treatment that perfect union was procured. This patient was afterwards lost sight of.

CASE II. *Fracture of the thigh; scrofulous diathesis; cure after about five months' treatment.*—A little girl, 8 months old, the child of a young and delicate mother, awakened her parents in the middle of the night by crying piteously. She was hushed for a time, but again awoke in the same way, and this was repeated through the following night; and it was not until the third day that the middle of the thigh was found to be swollen and the limb immovable. This was treated by one surgeon as curvature, and by another as swelling produced by cold; although the mother herself had remarked that the injured limb was at times shorter than the other. In this way four weeks were lost, when a third party was consulted, who gave it as his opinion that there had been fracture, but that then the case had become incurable. In despair, the mother brought her child to Paris, and when I saw her the following symptoms presented themselves: shortening of the thigh to the extent of about one inch; movement, but without crepitation, opposite a tumour which was painful to the touch; well-marked deviation of the thigh in a direction outwards, together with a looseness of the limb below the seat of fracture, when the child was held by the arm: but all these symptoms disappeared when gentle extension was applied by drawing down the heel, although they again became apparent when it was relaxed. Tonics were prescribed, and a bandage and long wooden splints were employed for keeping the parts at rest. After persisting in this treatment for fifty-two days, on removing the apparatus the shortening was no longer apparent; but this condition was only temporary, for on the following day the symptom in question again manifested itself. In spite of this discouraging result, the apparatus was reapplied after an interval of seven days, with renewed precautions to ensure the proper adjustment of the fracture, and with the employment of as much confinement to prevent any movement of the femur as the circumstances of the case rendered admissible: a tonic bitter mixture was prescribed, and a nutritious diet enjoined. The child improved in health and spirits; and when, at the expiration of a further term of sixty-two days, the splints were removed, union was found to be complete, the tumour having disappeared, and the natural mobility of the limb being restored without the production of the least pain. This case may serve as an example of the beneficial result of perseverance, even under circumstances of a most discouraging nature. It must not, however, be assumed that the diathesis in question always operates as an obstacle to the union of fracture, as will be proved by the following cases.

CASE III. *Fracture of both bones of the leg; scrofulous constitution; cure in thirty-five days.*—A child, 5 years of age, of small stature, and scrofulous temperament, as characterized by a large head, prominence of the frontal and occipital bones, with separation of the parietal, precocious intelligence, projection of the sternum, tumid abdomen, &c., had a fall whilst at play, and when brought to the Hôtel-Dieu was found to have broken both bones of the leg, at the junction of the middle and lower thirds. These fractures were reduced and retained in position by means of several pads and three splints, two lateral and one anterior, and over all a roller which extended from the knee upwards. On the following day the apparatus was reapplied, the limb being semiflexed, and placed on a pillow, with an additional small splint on either side of the leg, which were also confined by a roller. This case terminated favorably, in spite of inflamed and suppurating glands during the progress of the cure; for at the expiration of thirty-five days, when the splints were removed, union was found to be complete, and the leg, so far from being deformed, was straighter and more shapely than that of the opposite side.

CASE IV. *Fracture of the thigh; rickety diathesis; cure in forty days.*—Lemaître, 9 years old, possessing all the usual attributes of a scrofulous constitution, broke the right thigh about the middle, whilst at play. He was brought to the Hôtel-Dieu, where the usual apparatus was applied; and at the end of forty days, when this was removed, the fracture was found completely united. In this case likewise the limb had gained in form by the accident.

A want of proper adjustment of the fractured ends of a bone may be due to the interposition of fibrous or muscular tissue. But, in the greater proportion of cases, the formation of the callus is not prevented by this cause; for all the tissues which surround the injured parts more or less contribute in the production of this material, as will be shown in the next chapter.

The influence of cancer on fractures is also very marked; and not only does this peculiar diathesis render the bones obnoxious to fracture, from very slight causes, such as a trifling fall, a false step, or even a simple movement in some instances, but it also obstructs reunion, or renders it difficult and protracted. The following cases will serve to illustrate this fact.

Case V. *Oblique fracture of the left femur; great displacement, pulmonary catarrh, and death.*—M. A. Châtelin, aged 54, embroidress, of a very feeble constitution, came to the Hôtel-Dieu, to be treated for a fracture of the left thigh. She had just left the hospital La Charité, where she had been a patient six weeks, with some chest affection, and was in the act of stepping from a coach when she fell, and was unable to rise again. When admitted into the Hôtel-Dieu it was readily ascertained that there was an oblique fracture of the left femur, at the junction of the upper and middle thirds of the thigh, accompanied by great displacement outwards of the lower portion of the bone, which threatened to penetrate the skin; there was also considerable shortening of the limb, and marked inversion of the foot and knee. The reduction of the fracture was not difficult, and the apparatus usual in such cases was applied. The condition of this patient on her admission was such that no hopes were entertained of her long surviving; and this apprehension was realized by her death, which took place six days afterwards.

Autopsy. Lungs hepatized. Stomach and intestines very contracted in calibre, and uniformly of a bright red colour within. Left kidney unusually developed, but healthy; the right reduced to a mere membranous pouch, of large size, containing straw-coloured fluid, with flakes of albumen floating in it. On examining the fracture, which was found to be in the direction and at the spot mentioned, it was observed that the neighbouring muscles were infiltrated with blood, and that there had been no effort made to reunite the broken fragments, which, indeed, were not in contact. The femur presented here and there osteo-sarcomatous tumours, of an oblong form, and as large as an almond, or even larger. At these spots, in place of the osseous tissue, there was found a black, soft, spongy substance, which, on being detached, left openings directly communicating with the medullary canal; the latter was of unusual calibre, and its walls were thin and fragile. Is not this cancer affecting the bone itself? The third, fourth, and fifth true ribs of the left side had attached near to their cartilages a long tumour springing directly from the side of the chest; this was the same disease in an earlier stage. The horizontal ramus of the pubes was enlarged and converted into a dark spongy tissue, which was altogether unlike bone, or any other healthy texture.

If the cancerous diathesis makes the bones more brittle, it does not always present an obstacle to their consolidation. The numerous instances of women with cancer of the breast or womb, who have been under my care, both in public and private practice, for fractures which have united in the usual time, have long since satisfied me of the truth of this remark, which I may illustrate by the following case. Madame de M. was operated on six years since for a scirrhous tumour in the right breast. The operation was simple, and the patient was cured in six weeks, without the occurrence of any untoward symptom. Two years afterwards she was thrown down in the street by a carriage, and had her right leg broken at the junction of the middle and lower thirds. The case was treated in the usual way, and in spite of the feeble and emaciated state of the patient no bad symptom supervened, but on the thirty-eighth day the union was firm. This result was scarcely anticipated, and fears had been expressed that the disease of the breast, which had required its removal two years previously, might prove an obstacle to the consolidation of the fracture. The following cases, however, show that this diathesis has a tendency to counteract nature's work; and that if the cancer affects the bone itself, and a fracture ensues, the only resource is amputation.

CASE VI. *Cancerous diathesis displayed after the extirpation of a breast, and preventing the union of a fracture.*—C. Richard, aged 58, was admitted into the Hôtel-Dieu in November, 1829. For many years this woman had been the subject of a tumour in the breast, the first appearance of which was coincident with the suppression of menstruation. The scirrhous nature of this tumour being evident, it was removed at the

Hôtel-Dieu several months before her second admission. The operation was simple and favorable, and the wound soon healed; but the success was only apparent. Some months afterwards she returned to the hospital with a general uneasiness and undefined pains in the head and region of the liver: she was placed in a medical ward, and the physician treated her for rheumatism, and prescribed vapour-baths, which she was obliged to take outside the ward. One day, in going to the bath, she fractured her thigh about its middle, and was then transferred to a surgical ward, where the following circumstances were ascertained: the thigh was shortened and enlarged in circumference, the foot was everted, and there was crepitation. The limb was placed on a double inclined plane; but after two months of treatment there was no union; on the contrary, the constitution of the patient suffered, or rather the cancerous diathesis developed itself; there was emaciation, a yellow skin, loss of appetite; the urine and fæces passed involuntarily, &c., and death quickly ensued.

Autopsy.—There was adhesion of the pleura to the lungs, and the latter were gorged posteriorly; the bronchial glands were scirrhous, as also was the liver; and the cavities of the heart were slightly dilated. All the bones, and the ribs especially, were friable, but unchanged either in form or colour; the injured thigh was larger than the other, but the appearance of the skin was natural; the muscles were pale and atrophied. Close to the fracture was an immovable and rather hard tumour, adhering to the ununited fragments, and as large as the two fists; this was cancerous in its character at several points. The tissue of the injured femur was light and softened, and its medullary canal nearly obliterated. The foregoing case is an example of the cancerous diathesis, and of the influence it exercises on fractures.

CASE VII. *Fracture of the thigh; osteo-sarcoma of the femur; amputation, and subsequent cure.*—U. Laujai, aged 51, a washerwoman, of lymphatic diathesis and sluggish constitution, was admitted into the Hôtel-Dieu in June, 1820, with fracture of the right thigh. She gave the following account of herself. She was the mother of four children, and had menstruated regularly till within the last twelvemonth, when the catamenia ceased. Four years before her accident she had a fall on her right knee, which occasioned swelling and severe pain; from that time she suffered almost constantly in the thigh, which gradually enlarged, and the pain assumed a lancinating character. One day, whilst leaning on this limb, she felt a snap above the knee, and fell. Being brought immediately to the Hôtel-Dieu, a fracture of the lower portion of the femur was detected. The general condition of the patient, together with the cancerous affection of the femur, which, from the previous as well as the existing indications, could not be mistaken, were sufficient to point out the propriety of amputating the thigh, and the operation was accordingly performed. On examining the limb, the skin and subcutaneous cellular tissue were found to be lardaceous and scirrhous; the tendons and the nerves were converted into the same structure; the lower portion of the fractured femur presented here and there some spicula in cavities filled with a sanious secretion, whereas nearer the centre of the bone nothing but the sort of putrid mass above noticed could be distinguished. A few lines distant from the articular cartilages the bone was converted into a scirrhous mass, containing fragments of the original structure not yet disorganized; there was no change either in the cartilages or the articulation. The ligatures came away between the fourteenth and twenty-first day; no outward symptoms occurred, and the patient quitted the Hôtel-Dieu at the end of four months, with the stump perfectly healed, and walking with a wooden leg.

ON THE PRESENCE OF HYDATIDS IN BONES.

The subjoined case will suffice to show that cancer is not the only disease by which the union of a fracture may be retarded or prevented.

CASE. *Non-union of fracture of the humerus, dependent on the presence of numerous hydatids in the bone.*—Raimbault, aged 23, an agricultural labourer, of very good, strong constitution, was admitted into the Hôtel-Dieu in December 1832, for a long-standing fracture of the right humerus. The man stated that, wishing to frighten some young girls, he was pretending to throw stones at them, in doing which he carried his whole arm forcibly backwards, then, feigning a forward motion, he suddenly checked the limb. It was in making this effort that he felt a very sharp pain at the junction of the middle and lower thirds of the humerus; the arm fell, and he lost all power to raise it. On examination there was found to be deformity at the spot where the pain had been felt, together with abnormal mobility and prominence. Previous to the accident the patient had not received any blow, nor experienced any pain in the bone.

The surgeon, who had ascertained the nature of the injury in the first instance, applied a proper apparatus; but, in spite of its constant employment for seven months, the fracture remained ununited. The patient then determined on coming to Paris, and when he applied for admission into the hospital he was unable to lift up his arm: there was a considerable prominence anterior to the seat of fracture, and the ends of the bones were movable on each other, though no crepitus could be detected, which was easily accounted for by the time that had elapsed since the accident occurred.

The limb was put up in a fresh apparatus, and perfect repose was enjoined. Four months passed without any favorable result, the fracture remaining as movable as before; it was therefore determined that one or both of the fractured extremities of the bone should be excised, and this operation was accordingly performed in April, 1833, and brought to light the true cause of the fracture, which otherwise could hardly have been suspected.

An incision having been made on the outer side of the middle of the arm, the upper fragment was easily brought through the wound, and its extremity removed to the extent of some lines in length. When I was about to perform the same operation on the lower fragment, which there was considerable difficulty in raising, I was much astonished at discovering an osseous pouch, formed by the dilatation of the humerus, from which a good deal of adipocerous matter escaped, together with an innumerable quantity of membranous, vesicular, white hydatids of various sizes, some very small, others as large as a hazel-nut. All that were within reach were extracted, and the arm was then placed in the apparatus for *compound fractures.* The matter which was removed being heated with ether, deposited white, pearly particles on cooling. On the following and successive days a good many more hydatids came away from the wound. On the fifth day, two membranous, whitish, thick, cylindrical bodies, of the shape and calibre of the medullary cavity, were seen between the lips of the opening, and were removed without difficulty or pain; these were the debris of the sac which contained the hydatids. On the eighth day, the wound looked remarkably well, and yielded a copious discharge of pus; but this condition did not last long: the suppuration became more and more abundant, and the limb appeared to melt away into pus. The patient's strength was exhausted, purging came on, and death ensued about six weeks after the operation.[1]

Autopsy.—There was a little serum in the brain, and some blood was found in the sinuses and spinal marrow. The lungs and other viscera were healthy. In the left humerus there was no alteration, but the right was extensively diseased, the cavity of the bone being very thin and much distended; the chief dilatation being in the lower fragment, which was filled with pus. This large cavity was prolonged into the head of the bone, and was lined with a false membrane, which adhered to its internal surface, the latter being of a brownish colour through a great part of its extent. Every trace of the medulla and its membrane had disappeared. The shaft of the bone presented apertures at several points, some of sufficient size to admit the end of the little finger; the glenoid cavity was altered, softened, and blackish, and the upper part of the synovial capsule and cartilage was destroyed. The two bones of the fore-arm presented an incipient state of softening at their upper extremities. Several hydatids were found in the substance of the muscles of the arm.

When this man first presented himself, his case naturally suggested some reflections in regard to fractures of bones by muscular action. He had sustained neither blow nor fall; he was strong and in good health, and it was in the struggle between two opposing efforts that he experienced the sharp pain, arising, as the issue proved, from the fracture. Animated discussions have been raised respecting this cause of fracture in health and disease: of the possibility of such a result, under the former of these conditions, no reasonable doubt can be entertained, as regards the olecranon, the patella, and os calcis. A man under a heavy load, on the point of falling forwards, makes a strong effort to throw himself backwards and to keep his balance; the anterior muscles of the thigh contract violently, great pain is probably experienced at the same moment in the tibio-femoral articulation, and transverse fracture of the patella is not uncommonly the result. From fifteen to twenty such cases, or more, have come under my notice in the Hôtel-Dieu. A sudden and very violent extension of the fore-arm, by the action of the triceps, may also produce fracture of the olecranon, which happened whilst I was a student, to a person who, whilst playing at tennis, gave the ball a violent back-stroke with the racket, and immediately felt a sharp pain at the elbow. I examined the arm, and ascertained that the olecranon was fractured. The calcaneum may be included in the same category. J. L. Petit, Desault, and others have cited several instances of fracture of this bone, by the contraction of the gastrocnemei muscles.

---

[1] [This man had a good constitution; would it not perhaps have been advisable, taking into consideration the disease of the bone, and the great extent of the suppuration, to have amputated at the shoulder-joint?—Tr.]

These facts do not admit of a doubt, as all modern and contemporary authors agree on the subject. The question is not one which affects the fracture of long bones in a healthy state; for, when they are altered by scorbutic, syphilitic, cancerous, or scrofulous affections, or by atrophy in paralysis of the limbs, they are frequently and readily broken. Medical works contain numerous examples of patients affected by syphilis, whose largest and strongest bones were completely fractured by the ordinary action of the muscles. Every one knows the story of the gouty man (narrated by Fabricius after Sarrazin, a physician at Lyons), who broke his arm in drawing on his gloves; and also that of the nun, cited by Desault, whose arm was broken in supporting herself whilst getting out of a carriage: no union took place; and afterwards, whilst turning in her bed, she broke her thigh. We may also call to mind the cases of persons, affected with rickets and cancer, who have fractured their limbs in walking or running, or by some still simpler means.

Most authors concur in expressing a belief that sound bones are capable of resisting the most violent muscular contraction. Nevertheless, opinions do not entirely agree on this point: thus, in the Philosophical Transactions, there is an account of a fracture of the humerus, attributed solely to muscular action. Botentuit saw this accident happen, in the action of striking a shuttlecock with a battledore. Beaumarchef mentions a fracture of the lower third of the leg, produced likewise by muscular action. To the same cause we may ascribe the case of a young sailor (cited by Curet) who, whilst making water on deck, used violent exertion to save himself from being pitched overboard by the rolling of the vessel, and his femur was fractured by spasm of the muscles of the thigh; also that of a young negro, who, according to Poupée Desportes, was seized with a spasmodic affection of the muscles of the upper (lower?) extremities, and had the cervix femoris of either side fractured. Samuel Cooper (Dictionary of Practical Surgery) speaks of a man who broke his arm in striking a violent blow, whilst he missed his aim. Some months since a case was related in a medical journal, in which the clavicle had been fractured by violent contraction of the sterno-mastoid muscle. Finally, in Léveillé (Nouvelle Doctrine Chirurgicale), we find the case of a child, 11 or 12 years old, who broke the humerus in throwing a stone at a distant object.

Whatever inference may be drawn from these facts, the opinion that was first formed regarding the case above detailed was necessarily modified by the result of the operation; but it must be remembered that it was in the first instance impossible to ascertain the mischief, though it was afterwards clear that the condition of the bone, which had been dilated, thinned, and weakened by the presence of hydatids in the medullary canal, was the predisposing cause, and the muscular action the immediate cause of the accident. On making a careful examination of the arm before the operation, the only point observable through the soft parts was an unnatural amount of swelling about the humerus.

The presence of hydatids in the substance of the humerus is also a very unusual circumstance; indeed, the cases cited by authors, of hydatids in the bones generally, are very few; and the diagnosis is extremely difficult, not to say impossible: their existence can only be verified by the rupture of the inclosing cyst, either spontaneously or by operation. M. Cullerier had under his care a patient, with an indolent tumour on the anterior surface of the upper third of the tibia, of a steotomatous consistence, and bounded by an osseous uneven edge. The ordinary means of treatment having failed, caustic potash was applied. When the slough separated, a thick matter followed, of the colour of wine-lees and almost inodorous; and on examining the bottom of the opening, the tibia was found enlarged: M. Cullerier then resorted to actual cautery. The portion of bone that was cauterized covered a hole from which issued some small roundish bodies, three or four lines in diameter, and one exceeded an inch; these were hydatids of the kind named by Laënnec acephalocysts.

I once witnessed an instance of hydatids in the substance of the body of a vertebra; constituting one of those anomalous diseases, respecting which it is so difficult to form a correct diagnosis, and they were discovered only on opening the body: another case also occurred to me in which hydatid cysts were found in the inferior maxillary bone. The presence of hydatids in the vertebral canal is not so uncommon. I often met with them there, when I had the direction of the anatomical department at the Faculté de Médecine; and Chaussier, Esquirol, and Melier have cited some very remarkable instances of the same class. The result of a statistical comparison which I made of organic diseases in nearly fifteen hundred bodies, gave eighty in which hydatids were found. The evidence of their existence is very obscure, there being some cases in which their presence is unattended by any symptom during life, and others which are productive only of slight indisposition. Generally speaking, the instances in which they give rise to serious mischief are rare.

CHAPTER III.

ON THE FORMATION OF CALLUS; AND ON THE MEANS OF REMEDYING ITS FAULTY OR MISSHAPEN DEPOSIT.

There is probably no subject in pathological anatomy which has more largely exercised the sagacity of practical men and the imagination of theorists, without their having recourse to the aid of actual observation or experiment, than the question respecting the formation of callus. In modern times, two opinions in particular have been paramount, viz. those of Duhamel and Bordenave. The former of these attributed the consolidation of fractures to swelling of the periosteum and medullary membrane, to their extension from one fragment of the bone to the other, and ultimately to their reunion and ossification. According to him, this reunion was effected by a simple external annular deposit, or this was double, one division embracing the periphery of the fragment, whilst the other forced its way, like a peg, into the interior of the medullary canal. Bordenave's theory differed from this: he admitted that the reunion and consolidation of fractures are accomplished by a process analogous to that by which the healing of wounds in soft parts is effected. He thought he perceived cellular and vascular spots amongst the fragments of broken bone; and these, he conceived, coalesced, and afterwards became solid by the accumulation of phosphate of lime in their interior. John Hunter, again, ascribed all to the organization of the blood which is effused around and between the fragments of bone; whilst Camper maintained that reunion is due to the formation of a double layer of callus, the external portion of which is subjacent to the periosteum; and the internal (an expansion of the inner osseous laminæ) he describes as encroaching on the medullary canal.

These doctrines, with certain modifications, were generally received when I undertook, in 1808, to verify the opinions of Bordenave, which had been revived by Bichat. But I was much surprised, in examining the bodies of persons who had died after fractures, to find nothing which could be considered as confirmatory of the received opinions; and my further researches induced me to establish a theory, which was in part founded on that of Duhamel, but which involved the discovery of two new laws.

A natural distinction presents itself to the mind between the phenomena attendant on the deposit of callus in simple and complicated fractures; in the latter, where the displacement or destruction of texture is considerable, it is not the periosteum alone, but the filamentous tissue, ligaments, tendons, and even the muscles themselves which concur in the formation of callus.

In the second place, it was easy to perceive that Duhamel had stopped considerably short of the whole truth in his observations; he correctly described all that takes place in the periosteum and medullary membrane, and which constitutes the first stage in the curative process, but omits to notice that which invariably succeeds, and has for its seat the interval between the fragments; immediate reunion of the fracture, and progressive destruction of the first or preparative process, are effected by this second stage.

Convinced by my experiments that Nature never accomplishes the immediate union of a fracture, save by the formation of two successive deposits of callus, I have been induced to name one *provisional* and the other *permanent*. The former of these, which is usually perfected in about thirty or forty days, and which comprises the ossification due to the vessels of the periosteum, the filamentous tissue, sometimes even of the muscles, and of the medullary tissue, has not always strength enough (especially in oblique fractures), when the splints and other supports are removed, to resist the power of the muscles, or such passive force as may be applied, even to a moderate extent, to the seat of injury; and the brittleness of this provisional callus is such that the bone more readily yields at the point where it is deposited than at any other part. The second (permanent) callus, formed by the reunion of the surfaces of the fracture, possesses a solidity superior even to that of the bone itself, so that the latter would sooner break at any other point than where the former is deposited. The production and organization of the permanent callus is never completed under eight, ten, or twelve months, a period which is further marked by the disappearance of the provisional callus, and the renewed continuity of the medullary canal.

The following are the principal phenomena which may be observed during the time that elapses between the occurrence of the fracture and the complete and exact reunion of the broken bone; their succession is so constant and unvarying, that they may be referred to *five differenl periods.* The *first* extends over the eight or ten days which immediately succeed the accident, and presents the following characters: at the moment that the fracture occurs, the periosteum and medullary membrane, the filamentous tissue, and sometimes even the muscles, are torn; blood escapes from the ruptured vessels, and surrounds the fragments, is poured into the medullary canal, and distends the neighbouring filamentous tissue. After a time the vessels retract, and their mouths are closed, the blood ceases to escape, and a mild inflammation is set up in all these parts. The filamentous tissue, reddened by a multitude of small vessels, becomes distended, condensed, and thickened, losing its elasticity, and acquiring a remarkable consistence; irregular prolongations are sent from it into the interstices of the muscles, by which their organization is altered, and they are made to participate altogether or in part in the changes which are going on; their texture is transformed into one closely allied to the condensed filamentous, and they are united and confounded with the periosteum, which, in turn, is also thickened by a network of delicate red vessels distributed over its surface. The medulla being broken through and mingled with blood, at first swells out and hardens, and subsequently becomes of a greyish white colour. The medullary canal is contracted in its diameter by the encroachment of the thickened lining membrane, which assumes a reddish, fleshy, or pulpy appearance, resulting from a sort of gelatinous infiltration. The coagulum which results from the primary extravasation is absorbed and disappears. A stringy and viscid matter, sometimes presenting a gelatinous appearance, is poured out between the ends of the bone; occasionally likewise a reddish substance is developed in the same position, springing from the inequalities which present themselves; they grow and extend towards each other in the form of rosy points, and ultimately meet and interlace with each other. This production, the nature of which is but little understood, never acquires any great amount of thickness or density; it becomes continuous internally with the medullary membrane, and externally is identified with the congested soft parts; it is not always met with, and then the viscid and gelatinous matter of which mention has been made is alone present. Both of these structures, whether found separately or together, appear to play an important part in the production of the callus, but of the permanent callus only. The fragments of the bone are, in short, surrounded by the gorged soft parts, which are converted into a homogeneous tissue of a lardaceous consistence, and red colour, but varying in intensity.

The *second period* then commences, and comprises the interval between the tenth or twelfth day and the twentieth or twenty-fifth. The gorged condition of the surrounding soft parts diminishes, the muscular tissue resumes its distinctive characteristics, but the filamentous tissue continues condensed. The tumefaction is more concentrated immediately about the fracture, and gradually assumes a more circumscribed character, until it forms a distinct tumour isolated from all surrounding structures, not even excepting the tendons, which play in grooves channeled for them along its surface, or in perfect canals traversing its structure; such is the *callus*. This tumour is thicker on a level with the fracture than at any other point, and insensibly diminishes in density on either of the fragments. Its tissue is homogeneous, its colour white or whitish, its consistence firm, and its resistance analogous to that of the fibro-cartilages, giving out a similar sound when cut with a sharp knife. The deepest part of this structure, that which is formed by and continuous with the periosteum, is found to contract more close adhesions to the bones the nearer it approaches to the fracture, at which point it is difficult to separate them. If, however, this separation is effected with the aid of the handle of a scalpel, it is perceived that they are formed of longitudinal fibres parallel to those of the bones, and analogous to the fibre of tendons; or they may exist in the form of cartilaginous or osseous striæ, according to the more or less advanced condition of the provisional callus. Towards the extremities of the tumour formed by the callus, the periosteum becomes more distinct and easy to detach from the bone. The medullary membrane, swollen, tumid, and identified with the matter by which it is infiltrated, sometimes obliterates the canal, not only on a level with the fracture, but for some distance on either side of it; thus filling up the space usually occupied by the medulla, which is proportionately diminished in quantity; the cylinder which it forms passes rapidly into a cartilaginous state, and still more quickly into bone, becoming identified at the seat of fracture with the whitish, rosy, red, or violet-coloured, viscid, or gelatinous substance, as the case may be, which is interposed between the fragments; on the other hand, it is lost in the callus externally. Whilst in this condition it is still possible for the callus to yield opposite the fracture, but crepitus is rarely reproduced.

The *third period* extends from the twentieth or twenty-fifth day to the thirtieth, fortieth, or sixtieth, according to the rapidity of the work of reproduction, and the age, constitution, and health of the patient. The conversion into cartilage commences at the centre of the tumour, and proceeds towards its circumference, and ossification speedily succeeds; thus little by little, the whole mass of callus becomes converted into bone. The periosteum, which is abnormally thick, then ceases to present any trace of the solution of continuity to which it had been subjected; and the muscles and tendons become free, though their natural mobility is not quite restored, on account of the induration of the filamentous tissue. If, at this epoch, a section of the callus is made, the fractured ends of the bone are still found movable on each other, the condition of the intermediate substance not being as yet sensibly changed; and the tissue of the callus presents all the characteristics of the spongy texture of bone.

The *fourth period* includes the interval between the fiftieth or sixtieth day and the fifth or sixth month. The substance of the provisional callus becomes condensed, and passes from the condition of a spongy to that of a compact tissue, and the medullary canal is obliterated by osseous matter of greater or less density. The substance intervening between the fragments is reduced to a mere line of a different colour from the bone itself; it gradually assumes more consistence, loses its colour, and ultimately, towards the end of this period, becomes ossified: the definitive or permanent callus is then formed.

The *fifth* and *last period* embraces all the time which elapses between the fourth or sixth, and the eighth, tenth, or twelfth months. The temporary callus gradually diminishes in thickness, and at last disappears; the periosteum recovers its natural texture and density, and the muscles and tendons are restored to perfect liberty; the internal deposit of bone disappears, and the canal is insensibly re-established; the medullary membrane is repaired, and the medulla is reproduced. The process of consolidation is then completed.

The foregoing details are of great practical importance, as they indicate the precautions it is necessary to take during the progress of the cure of fractures generally, and more especially of oblique fractures affecting the long bones, of those of the cervix femoris, the patella, the olecranon, and the os calcis; in reference to which they offer a satisfactory explanation of the difficulty attending the cure, and of the giving way of the fractured ends resulting from the feeble resistance of the provisional callus. One of the most interesting and useful consequences of this doctrine is the correction of the deformed union of fractures, before the period of formation of the permanent callus. This important subject will come under consideration after I have illustrated the facts which have been laid before the reader, by citing some cases which occurred at the Hôtel-Dieu.

Case I. *Oblique fracture of the upper extremity of the left thigh; death.*—L. A. Hisse, aged 27, a porter, of a nervous constitution, but free from all venereal, scrofulous, or rickety taint, fell on the left side, in December 1812, whilst carrying a heavy weight. He attempted in vain to rise, for his left thigh was broken, and he was accordingly brought directly to the hospital, where a simple fracture of the femur was detected at the junction of its upper and middle thirds, its direction involving an obliquity of about two inches in extent. The limb was set in the following way: one assistant fixed the pelvis on either side, whilst a second, grasping the foot with his left hand and the heel with his right, made extension so as to restore the limb to its natural length, and even to render it a little longer than the other: in the mean while I distracted the attention of the patient as much as possible—a precaution which it is very valuable to bear in mind in the treatment of many surgical diseases. The shortening of the thigh and riding of the fractured ends being thus overcome, the ordinary apparatus was employed, and the limb laid on its back.

The usual care was taken in this case, and nothing untoward occurred to attract attention; so that on the forty-fourth day, as a solid callus seemed to unite the two fragments, the apparatus was removed, and neither displacement nor deformity of any sort existed. This favorable state of parts continued for eight and forty hours, but at the expiration of four days it was apparent that the limb had lost one inch in length. There could be no doubt then that the callus was not so solid as was at first believed; but as this very state was also favorable to the employment of remedial means, it was decided that recourse should be had to a modified apparatus of Desault, by which extension should be kept up. This application was attended with a great deal of pain to the patient, who, indeed, did not complain without good reason; and it was in vain represented to him that it was the only measure by which his limb could be restored; for his answer was, that he would rather limp all his life than submit to a week of such suffering; and acting upon this feeling, he continually disturbed the arrangement of the confining bandages. Nevertheless, in spite of his murmurs, and the appearance of sloughs at different parts of the leg, the employment of the extending apparatus was continued for the space of thirty-two days, and it was then finally removed, leaving still a slight amount of shortening, which was sufficiently accounted for by the restlessness of the patient: it was useless, however, at so late a period to hope for any further benefit from the renewal of this measure. After this some days passed away without the occurrence of anything to attract attention; but at length he began to complain of a good deal of pain in the left groin, where, on examination, several enlarged lymphatic ganglia were perceived, and shortly afterwards erysipelas made its appearance, which was soon succeeded by an attack of fever, that proved fatal in the course of a week, in spite of the active measures which were resorted to, in order to subdue it. This occurred ninety-four days after the receipt of the injury, and offered a favorable opportunity for examining the state of the fracture and its uniting medium.

Autopsy. The soft parts having been separated, the leg was divided with a saw, and the thigh disarticulated. The condition of the structures superficial to the callus presented nothing abnormal, the leg alone being infiltrated with pus. The seat of the fracture was discovered to be about an inch below the cervix femoris, and to extend from within outwards and upwards, the obliquity occupying about two inches of the shaft of the bone. The nature of the displacement which existed was such, that the lower fragment projected inwards and forwards nearly to a level with the neck of the bone, the upper fragment having of course an opposite direction and position: this arrangement, therefore, left a considerable portion of the fractured ends parallel and in contact, but still they were not continuous; for an osseous matter, of a spongy appearance and irregularly distributed, existed between the fragments; and the bed of compact tissue was seen to terminate abruptly, presenting a defined margin, as if the solution of continuity were quite recent, instead, as was the case, of its having occurred quite three months previously: there was, in short, no appearance of callus at this spot; it was only found deposited internal and external to the cylindrical shaft. Externally and behind, in the neighbourhood of the fracture, a bed of osseous and spongy matter was distinguished, which, at its central and thickest part, was about four lines in thickness, and which gradually became thinner and thinner along the two fragments, until it altogether disappeared. This osseous deposit adhered firmly to the exterior of the bone, of which indeed it seemed to be a production, but was, nevertheless, distinguished from it by its spongy nature, which formed a striking contrast with the compact tissue of the femur: it was, rather, furnished by the periosteum, and crossed from one fragment to the other, covering them to the extent of two inches, without at any point penetrating the interval between them. Anteriorly this matter existed to a similar extent, but was disposed in a different manner: as the upper fragment projected a little beyond the lower, the substance in question seemed to spring from the internal surface of the compact tissue of the former, to terminate on the external surface of the latter; nevertheless, the same spongy appearance characterized the production at this part, and its extent also was equivalent to that on the outer and back part. In the medullary canal there existed a similar matter, which extended in the form of a very thin layer transversely from one fragment to the other, likewise without introducing itself between the fractured extremities.

In dividing the bone, the saw passed very readily through the fracture and its connecting medium. The small trochanter was broken near to its base, and was drawn by the psoas and iliacus muscles a little forwards and upwards under the neck of the bone, which it touched with its point: it was invested by the same osseous and spongy tissue, very irregularly distributed, and presenting before and behind two rather deep excavations. This tissue, at certain spots, conveyed to the finger the same sensation as it would receive from a sponge filled with water which had begun to freeze. The fractured extremities of the bone admitted of slight motion between them: this mobility was referable exclusively to the seat of fracture, and the osseous matter which has been spoken of could be observed alternately to yield and return to its former condition, without actually giving way; thus offering a fresh proof that there was no continuity between the fragments, but that the apparent consolidation or bond of union consisted exclusively of the provisional callus of which mention has been made.

Case II. *Simple fracture of the tibia; death; autopsy.*—F. Gervais, aged 63, a mattress-carder, was admitted into the Hôtel-Dieu, in July 1819, with fracture of the left tibia. This patient was of a bilious temperament, and had rather feeble powers of constitution; the accident was caused by his being knocked down in a narrow street and run over by a coach, the wheel of which passed obliquely over the lower part of his left leg. The fracture was not detected by the surgeon who was first consulted, and ten days elapsed before he applied at the hospital. At this time the foot and leg were much swollen, and there was extensive ecchymosis over the calf, and a small superficial wound; but neither deviation of the foot, nor deformity at any part of the limb. A careful examination left no doubt of the existence of a fracture at the junction of the middle and lower thirds of the tibia, as crepitus and unnatural mobility were distinct at this point, though the swelling prevented the discovery of any inequality of the bone, had such existed. The usual apparatus was applied, and the limb in this instance placed in a semiflexed position on its outer side; and the splints, instead of being fixed externally and internally, were applied on the anterior and posterior surfaces of the limb, the object being to secure rest for the leg rather than to keep the fracture in position, as the integrity of the fibula and adaptation of the fractured ends to each other prevented displacement. No circumstance worthy of notice occurred during the treatment; on the fortieth day the apparatus was removed, and the union appeared firm and without deformity, with the exception of a trifling annular prominence at the seat of fracture, which was attributed to the presence of the callus. In the course of a fortnight afterwards this patient had a severe fit of indigestion from overloading his stomach; this brought on violent vomiting, attended with severe pain in the epigastrium and belly; which symptoms were quieted by appropriate measures: but he fell into a state of extreme exhaustion, from which he did not rally, and died two days afterwards.

Autopsy, twenty-four hours after death.—The lungs were rather loaded with blood; the stomach and intestines were excessively distended, but there were no well-marked evidences of inflammation; the liver was also very large, and presented several points of old adhesions to the neighbouring parietes of the abdomen. The left leg was in no way deformed or shortened. The muscles presented a natural appearance, and were found intimately adhering to a slight enlargement of the tibia, at the junction of its middle and lower thirds. This enlargement was rough and, as it were, mammillated on the surface, and involved the whole circumference of the bone to the extent of about an inch and a half, being, however, most prominent towards the interosseous space: it was solid and inflexible. The fibula had evidently been in no way implicated in the injury. The tibia being divided with a saw in its long axis, from before backwards, the line of fracture was exposed; it proved to be oblique, in a direction from below, upwards and backwards, and comprised between its extreme points an extent of about six lines. The coaptation was perfect, the line of compact tissue on the one extremity corresponding accurately to that on the other: the cancellated structure above and below the fracture was in a perfectly normal condition; but in the immediate neighbourhood of the solution of continuity, its natural consistence was altered into one of a more compact character, the surface appearing less spongy; and in the intervals between the osseous filaments which compose this texture, a thick, whitish, and very adherent substance was deposited, by which the interspaces in question were filled: the colour of this part was also of a more roseate hue than that of the rest of the bone: these peculiarities were likewise limited to an extent of about six lines. The half line of interval which existed between the fractured ends, and which indicated the track of the fracture, was occupied by a whitish, adhesive matter of little consistence, which was continuous with the new deposit in the cancellated structure. To within about one inch above the fracture the periosteum possessed its usual colour, consistence, and thickness: at that point it began to increase in density, and soon assumed an osseous character, still acquiring greater thickness until it reached a point on a level with the extremity of the upper fragment, where it corresponded to the intervening white substance: in its descent over the lower fragment the above characteristics were gradually lost as they were acquired above, and the periosteum insensibly resumed its normal appearance and texture. The thickest part of the periosteum (upwards of a line and a half in diameter) was, therefore, on a level with the fracture, and manifestly presented an osseous texture for about an inch and a half in extent: it possessed neither the appearance nor the colour of the compact tissue of the tibia, but seemed to be rather spongy in character, and was of a deeper pink colour than the rest of the bone; being similar in that respect to the bones of the fœtus: the surface of the bone to which this periosteum adhered was unequal, rugged, and furrowed longitudinally. After the section of the tibia had been made, it was found practicable to move the fragments from side to side, the substance between the two extremities yielding to the pressure as it affected one side or the other: but the osseous cylinder which the periosteum formed around the fracture in no way participated in these movements, but remained fixed and inflexible.

Case III. *Fracture of both bones of the leg; death and autopsy.*—Gamard, a water-carrier, aged 56, of a strong constitution, and sanguineous temperament, whilst in a state of complete drunkenness, was knocked down by the cart he was driving, the wheel of which, there is reason to believe, passed over his right leg; but he was too much intoxicated, when admitted into the Hôtel-Dieu, to give any farther account of himself than that he was knocked down and run over. The condition of the limb, however, left no doubt of the existence of a complete fracture of the leg, complicated by a good deal of contusion to the surrounding soft parts and extravasation of blood, and accompanied by considerable displacement, the pointed extremity of the upper portion of the bone pushing forward the integument covering the outer and fore part of the leg. He further had a deep contused wound of the right brow, and had been observed to spit a little blood at the moment the accident happened.

The usual means were employed for reducing the fracture, and the limb was placed, semiflexed, on its outer side; the patient was then bled and put on low diet. On the fourth day the skin began to inflame in the neighbourhood of the fracture, and shortly afterwards became tense and swollen; there was accompanying fever and much pain. This attack terminated in the formation of vesicles, which, when they burst, exposed an eschar, of a brownish, livid appearance, involving the skin to the extent of nearly two square inches. This part was dressed, and on the eleventh day the eschar separated, and the discharge of a quantity of blood, in clots and mixed with pus, followed, after which he was relieved. On the fourteenth day a sort of core, bathed in blood and pus, and apparently separated from the deeper textures, was discharged; and then the general and local symptoms rapidly improved. On the thirtieth day the callus was examined, and was found to be, at that early period, remarkably solid: but on the thirty-ninth the patient became suddenly extremely unwell; and he complained at the same time of his leg, which was found to be red and tense. These symptoms led me to fear, at the time, that an abscess was forming about the fracture, as there was increased suppuration from the wound: but the causes of alarm fortunately subsided in the course of a few days, although the quantity of pus discharged seemed to be greater than the inconsiderable size of the wound would have led me to anticipate.

On the forty-seventh day a small splinter presented itself at the mouth of the wound; it was extracted, and the quantity of discharge soon sensibly diminished. On the fifty-ninth day the callus having acquired sufficient solidity the apparatus was removed, and the wound dressed with dry lint; perfect rest for the leg was secured by encircling it with a folded sheet, the extremities of which were made fast to either side of the bedstead. At this period the health of the patient was much improved; but this satisfactory state of things was not destined to be of long continuance. About the seventy-third day after his admission into the hospital he was seized with a violent shivering fit, which was succeeded on the following day by general febrile disturbance, such as headache, hot and dry skin, redness of the tongue, &c.; and the affected leg became tense and covered with a diffused blush of red. This condition was met by free leeching, poultices, &c.; in spite of which a second and severer rigor than the former occurred on the following night: and on the succeeding day the symptoms were aggravated by delirium, and an extension of the red blush up the thigh even to the groin, the parts thus affected not yielding on pressure. Leeches were again resorted to, after which the patient became more calm. On the fourth day of this fresh attack there was a further accession of unfavorable symptoms, both local and general, the integuments of the limb being of a deeper hue, and ulceration having commenced at several points: from this time he gradually sank, and expired on the seventh day, which was also the seventy-ninth after his admission.[1]

Autopsy, forty-two hours after death.[2]—The viscera generally were pretty healthy, the only deviations from this condition of any interest being the following: the brain was pale, and infiltrated with a large quantity of pinkish serum, of which there were about two ounces in the ventricles; the arachnoid was also of a rather deep red hue, and the vessels (on the surface?) were very much gorged with blood. There was no abnormal condition of the arteries, excepting those of the affected limb, which were ossified: the heart also was healthy.

---

[1] [In England much more active treatment is generally adopted in these cases of severe phlegmonous inflammation, and frequently with the happiest results; such as free and sufficiently deep incisions, combined with general support.—Tr.]

[2] [The description of this post-mortem examination is unnecessarily lengthy and tedious, and has therefore been much curtailed, especially where the account does not appear to bear upon the points in question.—Tr.]

The fractured leg appeared somewhat shorter than the other, but the foot preserved its natural direction. The whole integument of this limb was of a violet hue, and gorged with serum, but there was no pus in the cellular tissue: the dorsal surface of the foot had passed into a state of mortification, and the tendons and muscles in this situation were bathed in pus: a quantity of thin, greenish matter was also found in the tibio-tarsal articulation, but the cartilages were unaltered, the synovial membrane alone appearing somewhat more dense than naturally. The deep surface of the muscles of the leg adhered to the callus, which was thrown out about the fracture; and the anterior and posterior tibial arteries, as well as the peroneal, were found entirely converted into bony canals. This change, which was rendered remarkable by its limited nature, extended from the popliteal artery to the ankle, commencing and terminating with equal abruptness. On raising all the soft parts, a considerable increase in the volume of the tibia, at the point corresponding to the fracture, was seen: the two ends of the bone were not in exact apposition, but there was considerable overlapping; the line of fracture extending obliquely, so as to allow the upper fragment of bone to rest against the fibula: the direction of the lower fragment was nearly vertical. It may be here remarked that this mal-adjustment often results from the position in which this patient's limb was placed, viz. on its outer side and semiflexed; and it is a cogent argument in favour of placing the limb on its posterior aspect, though the semiflexed condition may still be retained.[1]

The callus in the present case was not perfect, but admitted of some yielding when the extremities of the bone were bent in opposite directions: but there was, nevertheless, a considerable quantity of osseous matter deposited in a great part of the circumference of the callus, especially towards its inner side. The general arrangement of this connecting structure may be thus described. On the inner side of the tibia it sprang from the lower fragment of bone, and extended upwards to the superior portion, taking an oblique direction outwards, so as to invest this extremity, the abrupt prominence of which was thus softened down; it thence proceeded to the inner side of the upper fragment, which it lastly connected to the outer side of the lower. The interval between the two extremities of the fracture was thus completely occupied by this fibrous structure: that portion of it which was deposited on the anterior and posterior surfaces of the bone took a more direct course from the one fragment to the other. On the inferior articulation of the tibia there was a fissure which extended from before backwards, through the cartilage, and was as fresh in appearance as if it had been just made: this corresponded to a longitudinal fracture, involving the whole of the lower division of the bone, which it divided into two nearly symmetrical portions, as high up as the principal fracture. The callus surrounding the fibular fracture was more regular than that of the tibia, and likewise presented several ossific points, particularly externally, where it appeared especially associated with the periosteum.

---

[1] [It does not appear why the former of these positions was selected in the present case.—Tr.]

A longitudinal section of the tibia from side to side displayed more distinctly the displacement of the broken ends, and the angle formed by their reunion: the medullary canal appeared free, and the white lines of the external compact tissue could be traced into either of the fractured extremities farther than the intermediate spongy tissue, the internal margin of the superior extremity being nearly in contact with the outer line of the inferior. But the two fragments did not actually touch at any point, so that the relative position of the lines which represented the external compact tissue of the bone had an appearance like the letter N drawn out. As to the character of the uniting medium, it has already been remarked that it varied in some respects at different points: thus, on the inner side of the upper fragment the periosteum was manifestly ossified to the extent of nearly a line in thickness; whereas, on the corresponding side of the lower fragment the ossific deposit, which was treble this thickness, extended lower down on the bone, and expanded above into a broad and almost compact osseous development, which spread over the inner and posterior surfaces of the bone, proceeding from the interosseous ligament as far as the anterior and inner boundary of the two fragments, where it was continuous with a white, glistening, fibrous substance, which completed the investment.

This massive structure was, therefore, principally confined to the posterior division of the section; and in the midst, between it and the fragments, there existed a cavity, the interior of which was lined by a reddish membrane of moderate thickness, containing a greyish-coloured substance, of the consistence of callus. On the peroneal side of the fracture the periosteum was only increased in density, and of a glistening white appearance; it covered the lower fragment up to its extremity, and thence extended obliquely to the upper fragment, along the inner border of which it attached itself, but without investing its end, which was in direct contact with the muscles. The interval between the two fragments was entirely occupied by a substance which adhered to them with great firmness; this substance was of a pink hue, fibrous, glistening, and slightly extensible, so as to allow of motion analogous in amount and character to that which is admitted of between the bodies of the vertebræ.

Along the line which marked the course of the longitudinal fracture, a whitish, gelatinous substance of moderate consistence was thrown out, and occupied the neighbouring cancelli. The union of this fracture appeared perfect, not allowing of the slightest movement between the lateral halves of the bone which it originally separated.

The fracture of the fibula was a little below that of the tibia, and its union was effected by an intermediate substance, similar to that which united the tibial fracture. The fibular lesion presented this singular peculiarity, that the inferior fragment was split longitudinally from before backwards, and the upper portion of the bone was impacted between these segments. Some points of ossific deposit were visible on the posterior surface of this fracture, and the periosteum on its external border was also ossified; yet there was distinct mobility between the two ends of the bone. There intervened between the tibia and fibula only a thin bed of soft parts, but the two bones were not at all united to each other.[1]

---

[1] [The principal reason alleged in the text for this detailed account of the post-mortem appearances is, that it constitutes "an admirable exposition of the mechanism concerned in the formation of callus." It has been therefore considered due to the author, to give these details (though much curtailed) at greater length than would otherwise have been thought necessary.—Tr.]

In reviewing the facts relating to the union of fractures, the following phenomena may be successively enumerated as deserving attention: 1. That there is extravasation of blood, and that a viscid and glutinous matter is poured out between the broken ends of the bone. 2. That the tissues which surround them are in a state of ecchymosis, and are irritable and swollen. 3. That a cartilaginous and osseous ring is formed externally, whilst a corresponding structure is developed from the tumid medullary membrane, and occupies the interior of the bone. 4. That there is ossification of the substance intervening between the two fragments. 5. That the mass of callus diminishes, and the medullary canal is re-established, after which the surrounding structures resume their normal condition. We may infer, therefore, from what has been said, that the term of forty days, which is the limit fixed by many surgeons for the consolidation of a fractured bone, is quite insufficient; and that a much longer time is indispensable for the treatment of oblique fractures, or those in which there is overlapping of the broken extremities of the bone.

The mechanism concerned in the consolidation of fractures is now well understood: but in studying the regular progress of the phenomena as they usually present themselves, it behoves us to bear in mind that obstacles occasionally arise by which this normal course is interfered with or even arrested; and that in place of accurate adjustment and reunion, the ends of the bone assume an altered and defective relation to each other. Are we, then, under such circumstances, to leave this evil tendency to work its own mischief, involving as it does a disagreeable deformity, and curtailing the use of the limb; or ought not some effort to be made to remedy the defect, by re-establishing the normal direction of the limb? A knowledge of the facts already detailed affords a reply to this question.

It cannot but be interesting here to remark, that there exists considerable analogy between the deformities resulting from fracture and those which are attributable to other causes. It is well known how much benefit is derived from orthopedic means in this latter class of affections; and if vicious curvatures of many years' standing may be corrected without inconvenience, how much rather may we anticipate the same desirable results, by the employment of analogous means, where the deformity does not date longer than a few weeks back, and is only maintained by a newly-formed structure, which does not attain to the same consistence with bone until after the lapse of a very long time. These considerations naturally suggest two questions, viz. Can any means be resorted to for overcoming the resistance of callus without involving danger? and what limit of time is to be fixed within which such means may be employed? It would, of course, be very desirable to ascertain exactly the amount of tenacity possessed by callus at diffent epochs of its formation; and the best means of attaining this object is, by calculating the amount of force required to overcome the resistance of this new deposit. Some experiments were performed by Dr. Jacquemin with the view of settling this point: the first was upon a man, fifty-one years of age, who died of pneumonia forty-five days after his femur had been fractured; perpendicular traction was made in the axis of the bone, and the fractured extremities did not separate until a weight of sixty pounds was employed. In a second and similar experiment made upon a man of fifty-six years of age, whose humerus had been broken fifty-nine days before his death, the callus yielded on the application of fifty-five pounds. Now, as no circumstance is to be regarded as matter of indifference, where it can be brought to bear upon an operation of such delicacy as breaking through the callus of a fracture, it behoves the operator to take into consideration the age and state of health or disease of the patient, as well as the character of the bone which is the subject of the injury. The nature and amount of displacement which exists must also importantly influence the question; thus, for example, in displacement as regards direction, the callus may be more readily made to yield, and at a later period, than where the displacement affects the length of the limb. In my own opinion sixty days is the utmost limit within which it is admissible to attempt the restoration of a limb to its normal direction. M. Jacquemin, on the contrary, thinks that this term may be extended to three or even four months; and his opinion is founded on the impunity with which he has seen the necessary means employed, and his knowledge of the structure with which he has to deal.

Admitting, then, that the straightening of an awkwardly united bone is practicable, the next question is, by what means can this result be obtained? The ancients attached much importance to certain preparatory remedies for solving and dissolving the callus; but these are now fallen into disuse, and are forgotten. The methods now employed are of two kinds: the one, which is advocated by quacks and bone-setters, consists in breaking through the newly-formed connexions of a fracture by one sudden and violent effort; whilst the other and more rational proceeding accomplishes the same object by gentler means, the crooked limb being subjected to a graduated force, which is maintained and gradually augmented, through the medium of appropriate apparatus. Before any course is adopted, it is indispensable to ascertain the character of the displacement, and the causes which produced and perpetuated it: this information it is often difficult to obtain on account of the thickness of the surrounding soft parts, and the immobility of the fracture. The next preliminary is to calculate the amount of force requisite for overcoming the resistance likely to be offered by the callus, and then to employ it accordingly. The following cases are intended to illustrate the principles which the above remarks involve.

Case IV. *Fracture of the left radius, neglected for twenty days, and consequent vicious union. Rupture of the callus, and cure.*—L., aged 69, of a good constitution, was admitted into the Hôtel-Dieu, December 11th, 1820, with fracture of the left radius near its lower extremity, the accident having been produced by a fall from a height on the palm of the hand. No advice had been sought, as the patient was under the impression that she was only suffering from a sprain. There was much pain and swelling, with daily increasing deformity; and the condition of the parts was such as to render it more than probable that total loss of supination and pronation would have been the consequence of the vicious union which was in progress; for the hand was in a position of extreme abduction, a deep depression existed at the lower part of the radius on a level with the fracture, and the rotatory movements of the fore-arm had already become excessively painful, and almost impracticable. In spite of the time that had elapsed, it was determined that an attempt should be carefully made to break through the recent callus, and the operation was performed in the following way. An assistant was directed to grasp the upper part of the fore-arm, for the purpose of keeping up counter-extension, whilst I myself seized the hand, and adducted it gradually, and with due regard, to the precautions requisite under the circumstances. The callus yielded, and the fractured extremities were carried outwards; the necessary consequence being the restoration of the proper interosseal space. The after-treatment consisted in the employment of the usual apparatus for such cases, with the addition of the ulnar splint described in a previous chapter.[1]

Not a single untoward symptom occurred; and on the thirty-second day the union was found to be complete. When the patient left the hospital three days afterwards, all deformity had disappeared, the interosseous space was restored, and the various movements of the limb were beginning to be performed without difficulty.

CASE V. *Fracture of the metacarpal bone, followed by deformity, successfully treated by bandaging.*—Pinard, a wine-seller, had his hand crushed between a falling barrel and a step of a ladder on which he was standing. He was admitted into the Hôtel-Dieu on the following day, when the hand was extremely swollen, red, and tense: the thumb presented a large contused wound on its dorsal surface; and the middle finger, including its metacarpal bone, was fractured at several points, as was evidenced by the mobility of the fragments on each other, and the crepitus resulting therefrom. The wound was dressed, and the palmar surface of the hand placed on a straight splint, in which position it was confined by a roller. On the tenth day the subsidence of the swelling permitted a more careful examination, when it was found that the second, third, and fourth metacarpal bones were fractured. A fresh apparatus was therefore applied, consisting of a front splint adjusted to the hand, and having a separate compartment for the thumb; compresses were applied on the back of the hand, and over them a second splint, the whole being confined as before by a roller rather tightly applied. This treatment was persisted in for nineteen days, at the expiration of which time the hand was again examined, but the condition of parts was anything but satisfactory; for, at the points corresponding to the fractures, there were three distinct prominences on the back of the hand, which were evidently produced by the overlapping and projection of the carpal portions of the broken metacarpal bones; and these were already united in this defective position by the callus which had been thrown out. With a view to remedying this deformity, two splints, with pads, were severally placed transversely on the palmar and dorsal surface of the hand, and attached at their extremities by strings which passed around them, and bound them together. The effect of this arrangement was to compress the hand, especially at the points where the metacarpus was most prominent: and the amount of pressure being gradually increased, a marked diminution in the extent of the deformity was apparent at the end of a week; and in a fortnight or three weeks more, the hand had nearly regained its natural form.

---

[1] See page 16.

CASE VI. *Fracture of the radius, followed by defective union, and subsequent restoration.*—J. Heitz, aged 21, a cooper, of robust frame, fell from the imperial of a diligence, and the principal weight of the body being concentrated on the right hand, a fracture of the lower extremity of the radius was produced. He entered a neighbouring hospital, where, after the swelling was reduced, appropriate pads and splints were applied for the treatment of the fracture. In the course of a few days, getting weary of the confinement, he threw off the apparatus, and continued his journey, making occasional use of his hand in spite of the pain it caused him. On arriving at Paris, he presented himself at the Hôtel-Dieu, and was admitted. A fracture of the radius, about an inch from its carpal extremity, was readily detected: it was accompanied by a marked abduction of the hand; and, opposite the seat of fracture, an angular depression was observable, which was the consequence of the approximation of both fractured extremities to the ulna: there was, moreover, an overlapping of the two fragments, the upper portion of the bone being carried backwards, by which an additional deformity was produced; and, from the relative prominence of the carpus, an appearance of dislocation of the radius forwards was presented. There was no crepitus, and but slight mobility, which conditions were sufficiently accounted for by the commencing union of the fracture.

For some reason this patient falsely represented that the accident had occurred only ten days previously, and thus misled me into the impression that the callus would yield more readily than the result proved: before any attempt was made he was freely bled and had a warm bath. For the purpose of making counter-extension a bandage was passed through the axilla, and its two extremities were attached to a fixed point; and for extension a noose was passed over the wrist, and the ends of the bandage by which it was formed were intrusted to assistants: lastly, grasping the hand myself, I forcibly adducted it in such manner as to stretch or break through the callus, and to separate the fractured extremities from each other. This first attempt was partially successful, the second more so; and at the third the accurate adjustment of the fragments was obtained, and all deformity removed. This occurred, as was afterwards ascertained, about three weeks after the accident; and all that remained to be done was to keep the parts in the position which they had assumed. This was effected by placing the arm in a semiflexed position, continued extension was employed in such way as to produce adduction of the hand, at the same time that the interrosseal space was well padded before and behind, and splints applied over the compresses. But these means were found insufficient to counteract the tendency that existed to an inclination of the hand towards the radius; and it was found necessary here, as previously, to have recourse to the splint referred to in Case IV. The patient was then sent to bed, having suffered a good deal of pain during the efforts at reduction and subsequently. At the end of ten days all swelling and pain had subsided, and the adjustment of the fracture continued accurate; and after the continuance of the treatment for three weeks altogether, union without any deformity had taken place, and the patient left the hospital well.

CASE VII. *Fracture of the radius straightened after five weeks.*—Auvernet, a coachman, 36 years of age, was thrown from his box, and the weight of the body was received on the left wrist, which was thus subjected to an excessive degree of flexion; at the same moment a distinct snap was heard, but the accompanying pain was not extreme. Finding his hand useless, he sought admittance, on the following day, into the Hôtel-Dieu; at which time there was some swelling about the wrist-joint, the movements of flexion and extension were painful, and those of pronation and supination impracticable. The patient was superficially examined by the surgeon in attendance, and the injury taken for a sprain, and treated for a fortnight accordingly. At the expiration of this time, all swelling and ecchymosis having disappeared, a bandage was rather tightly applied; fracture being still unsuspected, in spite of the fixed condition of the fore-arm as regarded its rotatory movements. This treatment was continued until the thirty-fifth day after the accident, when I found, on examining the wrist, that the inferior extremity of the radius presented a marked prominence on the back of the fore-arm; whilst the shaft of that bone was approximated to the ulna, and, overlapping the separated fragment, exhibited a similar projection anteriorly, but close to the carpal articulation. It thus appeared that the accident was in reality an oblique fracture of the radius, in a direction downwards and forwards. Previous experience having proved that the callus had not yet assumed its permanent condition, it was thought advisable to attempt the correction of the defective union. Extension and counter-extension were made as in the last case, whilst I employed pressure in an appropriate direction to bring the broken ends of the bone into proper relation; and as this was accomplished a distinct snap was audible, after which the deformity disappeared. A similar apparatus to that already described was then applied, and kept on for a month; and the patient, ultimately, regained the perfect use of the limb.

Case VIII. *Fracture of the radius; defective union, and subsequent restoration.*—Madame L., aged 69, fell, in the street, with her whole weight on the palm of the left hand. Severe pain was felt in the wrist, succeeded speedily by swelling; but the patient, conceiving she had only sprained the joint, did not seek any medical advice, but employed simple
cations, until driven by the deformity a
to apply for admission into the

then elapsed since the accident: there was extreme abduction of the hand, and a depression near the lower extremity of the radius; the rotatory movements of the fore-arm were, moreover, very painful and almost impracticable. The same means were employed for the reduction as in the former cases, and with immediate and perfect success; for the deformity disappeared, and the interosseal space was restored. The usual apparatus, with the addition of the ulna splint, was then applied, and on the thirty-second day the union was complete, and no vestige of deformity remained.

Case IX. *Fracture of both bones of the leg with lateral deformity, corrected on the twenty-ninth day.*—L., aged 27, fell from a third-story window, and was unable to rise. This case was likewise neglected for three weeks, at the end of which time the patient was brought to the Hôtel-Dieu. The foot was then extremely everted,and the leg appeared as if formed of two separate portions, united a little below its centre at an angle of about forty-five degrees, the prominence of the angle being directed inwards. It was evident, in short, that both bones of the leg had been broken, and that reunion was already in great measure accomplished; for the whole leg moved together, and no crepitus could be elicited by attempting to act upon the fragments separately. On the following day, which was the twenty-ninth after the accident, the ordinary internal splint for fractured fibula was applied, as this was calculated, without the employment of any previous effort at reduction, to counteract the obliquity of the limb. This was effected in the following way: the angle formed by the fracture being directed inwards, was necessarily accompanied by great eversion of the foot, and involved considerable separation of this division of the limb from the splint in question: thus, when a bandage was applied so as to include both the splint and lower portion of the leg, and drawn tightly, it had the effect of tending to approximate them, and, consequently, of giving a similar direction to the portions of bone which were above and below the seat of fracture. Accordingly, as the roller was tightened it was apparent that the callus yielded, and that the angle was diminished; but as the patient complained a good deal the reduction was not completed at once; the splint, however, was not removed, and the limb was semiflexed and laid on its outer side. Three days afterwards the roller was further tightened, and the straightness of the bones restored; indeed, a slight curvature in the opposite direction was obtained. The apparatus was reapplied every ten days; no untoward symptom occurred, and on the fortieth day the splint was relinquished, the union being firm, and the limb having regained its natural form so completely as to render it difficult to distinguish which of the two legs had been broken.

Case X. *Fracture of the lower extremity of the radius, succeeded by deformed union, which was subsequently corrected.*—J. Bechet, 10 years of age, fell about fifteen feet from a branch of a tree to which he was clinging: his hands, knees, and face all suffered from the fall, but it was his right wrist which received the principal shock; and he says that at the same moment he felt a crack, though he does not know to what part of the body to refer it. A surgeon, who was called in on the spot, pronounced the injury to be a sprain, and ordered leeches and poultices. Matters not being mended by this course, the patient was brought to me at the end of a month; when the evidences of fracture having existed were apparent in the abduction of the hand, and an angular depression about an inch from the styloid process of the radius: the union, however, was so far advanced that neither mobility nor crepitation were perceptible. Nevertheless, I determined to attempt the reduction, although opposed by another surgeon who had been consulted. On the following day the same method was pursued as in the cases already detailed; and by keeping up the extension, &c. for a time, the interosseous space was gradually restored, and the two extremities of the bone were brought into the same line; immediately after which the usual apparatus was applied, with the addition of the bent ulna splint, by which extension and counter-extension were kept up. On the third day, when the splints were removed, the deformity had almost disappeared; some further gentle efforts were made to restore entirely the straightness of the bone, which were successful, and the apparatus was then reapplied. In the course of a few weeks the arm was as [illegible]re the accident.

Case XI. *Fracture of the radius, united at an angle, and re-set after thirty days.*—M. U. Perrot, aged 13, fell from a tree, and the weight of the body was transmitted to the ground through the palm of the right hand. The accident, which was accompanied by acute pain, produced deformity of the fore-arm, sufficiently marked to attract the attention of the child's parents, who, being at a distance from Paris, sent for a noted bone-setter; he pronounced that the wrist was put out, and by some manipulation removed the deformity, and afterwards bandaged the part. The child, being allowed to follow his own bent, soon reproduced the mischief, and the faith of the parents in the bone-setter being disturbed, they sent for a neighbouring priest, who was no less renowned for the marvellous cures he had effected. As might be anticipated, his first act was to disparage his predecessor, affirming that the treatment had been misdirected, and that a few leeches were all that was required to remedy the deformity. His prediction likewise failing of fulfilment, the child was at last brought to Paris, where the fracture of the radius, about an inch and a half above the carpal joint, was at once detected, the displacement being in this instance in a direction so that the two ends of the fracture formed a projection on the palmar aspect of the arm. So marked was this deformity, that at first sight it was suspected that both bones were broken, but a more careful examination proved that this supposition was erroneous: union was already firm, for thirty days had elapsed since the accident. The same steps were taken for the reduction as in the cases already narrated, the local pressure being, of course, directed so as to force the projecting fragments backwards into their proper position. The desired effect was obtained without the employment of much violence or the infliction of great pain; and in this instance no snap or crack accompanied the operation: splints and pads were immediately applied, so as to act upon the partial prominence which still remained at the seat of fracture. At the end of a week still further improvement was perceptible; and the altered condition of the limb was rendered more palpable by contrasting it with a plaster cast, which had been made previous to the extension. In six weeks the cure was complete, and no difference could be observed between the two arms.

Case XII. *Fracture of the left radius; deformed union, corrected after thirty-two days.*—M. Hugot, subject to fits, fell during an attack on her left hand. Fracture of the radius was the consequence, which was marked by abduction of the hand and other symptoms already described as usually accompanying this injury near to the wrist-joint. The same plan of treatment was adopted, and with similar success, as in the last case; and the patient quitted the hospital well, at the end of three weeks.

Case XIII. *Fracture of the leg united with deformity, and re-set on the fifty-ninth day.*—A., aged 44, fell from his horse whilst riding in the street, and was immediately conveyed to the hospital, in a state of complete intoxication. Besides other minor injuries, he had a loose fracture of both bones of one leg; and so insensible was he to pain, that he made attempts to move and raise himself, by which, but for a strong boot, the simple would probably have been converted into a compound fracture.

Being too intractable to manage on that evening, the perfect reduction of the limb was left until the following day, when a more accurate examination proved that the fracture was oblique in a direction from below upwards and backwards, and near the lower third of the leg; the pointed upper portion of the tibia threatening to project through the skin on the inner and fore part of the limb. The resulting deformity was shortening accompanied by angular curvature. The usual means were employed for preserving the proper relation of the bones, and the limb was laid on its outer side. Considerable inflammation succeeded, and an abscess formed opposite the seat of fracture: these symptoms were met by appropriate remedies, but the progress of the case was rendered unsatisfactory by the want of docility on the part of the patient, who was constantly changing his position, and otherwise interfering with the treatment. In short, at the end of two months, when the swelling had entirely subsided, and the splints were removed, it was evident that the union, which had by this time acquired considerable firmness, was defective in direction, presenting a marked prominence on the anterior part of the leg opposite to the fracture.

The following measures were taken for restoring the limb to its normal form. First of all, some moderate efforts were made by pressure at the point of union, whilst assistants were making extension and counter-extension; and then a large cushion was applied to the posterior part of the limb, folded in such manner that the smallest part corresponded to the ham and the thickest part to the heel; over this an inflexible splint of the same length was laid, and the whole was bound together by a roller. A smaller cushion was placed over the prominence formed by the lower extremity of the upper fragment of bone, and another roller was made to include this and the apparatus already described; the object of the anterior pad being to assist in forcing back the displaced bone into proper position. Lastly, the limb was semiflexed and placed on its outer side, by which the relaxation of the muscles likely to act on the fracture was secured. It was found requisite to tighten this apparatus from time to time, and at the expiration of a month the leg was restored to its normal form: in the course of a few days more the patient began to walk with crutches, and soon afterwards left the hospital well, about four months after the occurrence of the accident.

Case XIV. *Fracture of the shaft of the femur, reduced after seventy days.*—Jacques D., 4 years of age, was brought to me for advice, having the right thigh very decidedly shortened, and presenting a convexity forwards about its centre: the child was unable to bear his weight upon the part without pain. The only history given was, that the little patient had had a fall ten weeks previously, since which time he had continually suffered in the limb and been a cripple; his general health was good, and there existed no evidence of his being of a scrofulous diathesis. Being convinced from the circumstances above narrated that the thigh had been fractured, I did not hesitate at once to employ extension and counter-extension, at the same time that firm pressure was made on the anterior part of the thigh. The fracture yielded; and immediately afterwards a roller and three splints of the length of the thigh were applied, the anterior being just sufficiently flexible to press especially on the seat of injury: two further splints were adapted to the whole length of the limb, that on the outside extending from the crest of the ilium to the foot, whilst the inner one was rather shorter and padded: these, being fixed by tapes, gave more firmness to the rest of the apparatus. The splints were re-adjusted about every fortnight, and at the end of ten weeks they were finally removed, as there no longer remained any deformity; the child recovered without any lameness.

Case XV. *Fracture of both bones of the leg, reduced after three months and a half.*—Michel H., locksmith, aged 31, broke his right leg in its lower third three months and a half before I was called in. The superior portion of the tibia formed a prominence on the inner side of the leg, projecting across the lower portion to the extent of several lines. The tibia was but imperfectly united, the fibula completely so; and the patient seemed exhausted and weak. The fracture was reduced by employing passive motion (which was directed so as to act upon the seat of injury), whilst assistants made extension and counter-extension. The limb resumed its normal form, and, as it was shrunk and wasted, a roller and thin splints were selected, and applied so as to avoid painful pressure; and over these, as in the last case, two long splints were adapted. When the splints were removed at the end of a month, the form of the limb was very greatly improved: they were reapplied, and kept on for three months longer, when they were replaced by a simple roller. Unfortunately the patient began to move about without permission, and it was remarked that the fracture was still movable: the apparatus was accordingly reapplied, and the patient confined to bed for two months longer, after which period the callus was found to have attained sufficient firmness to bear the weight of the body.

Case XVI. *Fracture of the fore-arm reduced after the lapse of four months.*—A. Lacuée, chambermaid, aged 28, applied to me in 1802. Four months previously she had fallen on her right fore-arm, which accident produced a fracture of both bones about the centre. The hand was in a state of extreme pronation; and at the seat of fracture a prominence on the palmar surface of the arm was observable, which corresponded to a depression on the dorsal aspect; the fore-arm was further shortened: it was evident, in short, that there had been fracture, and that there was, at the period of application, deformed union. For the purpose of reduction the fore-arm was semiflexed, and whilst extension and counter-extension were being made, the prominence at the seat of injury was firmly compressed: the fracture almost immediately yielded. A suitable apparatus was forthwith applied, and care was taken to make pressure on the prominence by graduated pads of proper thickness. In thirty days the fracture was reunited without deformity.[1]

The preceding cases can leave no doubt as to the practicability of re-setting defectively united fractures, without dangerous consequences, even after the lapse of a considerable time. As regards the limit within which the attempt is admissible, it is scarcely necessary to repeat that the circumstances of age, health of the patient, nature of the bone to be operated on, &c., must be taken into the consideration. The following table, drawn up from authentic cases, presents the reader with the most interesting statistical points associated with them.

Age.	*Sex.*	*Seat of Fracture.*	*Date of re-setting.*	*Period of Cure.*
69	Woman	Radius	20 days	32 days
21	Man	Radius	22 —	21 —
69	Woman	Radius	25 —	32 —
36	Man	Radius	25 —	30 —
27	Man	Leg	29 —	40 —
10	Man	Radius	29 —	38 —
13	Man	Radius	30 —	40 —
26	Man	Radius	32 —	40 —
5	Man	Fore-arm	40 —	36 —
44	Man	Leg	59 —	38 —
4	Man	Femur	70 —	70 —
55	Man	Leg	3 months	3 months
32	Man	Leg	2½ —	5 —
28	Woman	Radius	4 —	30 days
58	Man	Leg	6 —	3 months

Without wishing to draw any conclusions from this limited number of cases, it may, nevertheless, be remarked, that the radius is the bone which presents the greatest number of instances of union attended with deformity; but at the same time, when this was corrected, it was succeeded by the most speedy cure. It will be also perceived that, in the majority of the cases, men were the subjects of the injury, the proportion being that of twelve to three. In this respect the present table merely coincides with the ascertained fact relative to fractures generally. The period of re-setting fluctuated between twenty days and six months, and in general the cure bore a relation to the date at which the readjustment of the fracture was undertaken after the injury; thus where the latter was recent the former was speedy, and the converse.

---

[1] [The date of the earliest of the foregoing cases is 1802, and that of the latest, 1826.—TR.]

Of the different kinds of displacement which may accompany fracture, that affecting the direction of a bone is most important in its bearings upon the present division of our subject, as it is that in which the callus may be most easily forced to yield, and at a period farther removed from that of the injury. This species of displacement results from various causes, such as the patient using the limb too soon, and before the callus has acquired sufficient resistance; it may also arise during the treatment, in consequence of the limb not being sufficiently and equally supported throughout. This comes to pass, for example, when the leg is placed on its posterior surface, but does not rest on a perfectly horizontal plane, the heel being allowed to depend; or, again, when the limb is laid on its outer side, and the patient, instead of lying on the corresponding side of the body, lies on his back, or raises his knee on a pillow. In the former of these instances the weight of the lower part of the leg and foot produces an angular displacement of the fracture, and the upper fragment of bone projects forwards; the reverse being the case when the heel is too much raised: in the latter instance the weight of the limb and action of the muscles concur to produce a similar lateral displacement.

The simple conclusion to be deduced from the facts above detailed, supported by experiments on living animals, and the examination of the bodies of individuals who have survived fractures for different periods, appears to be this,—that in general it may be considered practicable to overcome the resistance of the callus within a period not exceeding sixty days from the date of the injury; but that some exceptional instances prove that this operation has been successful even after the lapse of a much longer interval of time.

Of the many methods proposed and employed for overcoming the resistance of the callus, the following may be cursorily noticed: 1. *Rupture of the callus,* by striking or forcibly bending it, as you would break a stick, has been already deprecated as an inconsistent absurdity. 2. *Permanent extension* may be applied by the aid of the ordinary apparatus, or of such as is specially adapted for gradually extending a limb: when there is riding of the fractured ends of the bone, and the callus is still in its provisional condition, this is certainly the most rational method that can be adopted. 3. *Compression* is principally suited to angular deformity, and may be applied through the medium of common splints or other appropriate mechanical means: its usefulness is likewise limited to the earlier period of reparation. This method is employed in Germany, but combined with mercurial infriction. 4. *Section of the callus,* which consists in exposing and dividing it with saw or scissors, is the only mode of remedying an union of the bones of the fore-arm to each other. Lastly, the seton has been recommended, and is associated with the name of Weinhold.

Before anything is undertaken, it is an indispensable preliminary step to ascertain the character of the displacement, as well as the causes which determined and maintained it. A correct knowledge of these points will tend materially to assist the operator in the necessary steps for effecting his object, both in regulating the amount of force to be employed and its appropriate direction. In making the first attempts at reduction, the ordinary rules relating to extension and counter-extension must guide the surgeon and his assistants; such, for instance, as a semiflexed position of the limb, to secure relaxation of the muscles, distracting the attention of the patient, &c. The force should be gradually augmented and regulated according to the suffering of the patient; and when the callus has yielded, suitable measures should be forthwith taken to preserve the advantage gained. Let us suppose, for example, the existence of a fracture united at an angle; the limb is compressed between two inflexible planes, and as the prominent points are thus brought most under command of the pressure, the tendency necessarily is to restore the bone to its natural straightness. But if further additional pressure is exercised by the interposition of pads, it is even practicable to bend the bone in the opposite direction. A similar result may be obtained by indirect means, such as employing the lower extremity of the fractured bone as a lever, and thus bringing it into proper relation with the upper portion. It is upon these principles that my apparatus for fracture of the fibula and radius are constructed; and their value in correcting deformed union of fractures has been illustrated in the preceding cases.

It may be readily conceived that the apparatus employed for this purpose must be, in the first instance, more firmly and tightly applied and more carefully watched than where the fracture is recent. Where much pain and swelling follow, the bandages should be relaxed; and under any circumstances it is desirable to raise the apparatus for the purpose of examining the state of the limb on the third or fourth day, and of renewing the efforts for reduction if needed. This should be repeated at short intervals, until the normal form of the limb is restored; and in this way, by taking care that every point gained is preserved, the desired effect is ultimately obtained. Where it is requisite to have recourse to extension in order to lengthen a shortened limb, care should be taken not to continue the operation of this agent too long, as reunion will be thereby interfered with. The subsequent treatment resolves itself into that of ordinary fractures; and, whatever may be the opinion of others, I think it far wiser to err on the prudent side, by protracting the treatment of these cases to a period at least equal in duration to that which is required for the cure of recent fractures.

CHAPTER IV.

ON FRACTURES OF THE UPPER EXTREMITY OF THE HUMERUS, AND DISLOCATIONS OF THIS BONE; WITH THE DIAGNOSTIC DIFFERENCES BETWEEN THEM. ON THE REDUCTION OF DISLOCATIONS, ACCORDING TO THE METHOD OF WHITE AND MOTHE.

ALTHOUGH a celebrated writer has affirmed, in allusion to these fractures and dislocations, that there are few diseases of which the nature is better understood, or in which surgical science approaches more nearly to the ideal of perfection,—it will be shown, in the course of the present chapter, how unfounded this assertion is; and how much more so it must have been at the period of its publication, when many questions of great practical importance were not even mooted, and yet remained unsolved.

It was laid down as an established principle that, in the enarthrotic joints, the luxation is always *complete;* but I have proved by facts that they are sometimes incomplete in the scapulo-humeral articulation. The distinctive indications of luxation and fracture of the upper extremity of the humerus were very vague, and in many instances the surgeon was, consequently, at fault; but I have succeeded, in a recent case, in characterizing these injuries with great exactness. In many, and especially in old, dislocations, the common process of reduction was inefficient, even in the hands of the most skilful operator; I have, however, lately tried a method but little known, which has been very successful in many instances, and from which I anticipate still further advantage in similar cases. Finally, no one had touched upon the important question of ascertaining the limit, in point of time, at which dislocations in general, and especially those now under consideration, admit of reduction; until I took the opportunity, in my clinical lectures, of indicating the proper course to be pursued under such circumstances. The following cases will serve to illustrate the above remarks.

CASE I. *Dislocation of the head of the humerus, reduced according to Mothe's method.*[1]—A beggar-woman, aged 41, was admitted into the Hôtel-Dieu, on the 5th of August, 1831, who stated that on the 9th of July, late at night, she was in the moats which surround the Champ de Mars, and was assaulted by several persons, who threw her down and beat her; and on rising she exclaimed that her arm was put out. Some days afterwards she was carried to the Hospital of Saint-Lazare, where the medical attendants supposed that she was suffering from dislocation of the humerus, and made four several attempts to reduce it, but without any other effect than that of increasing the pain. After these fruitless endeavours, she said that she felt a numbness in the fore-arm and fingers, which she had not experienced previously. She did not come to the Hôtel-Dieu till a month after the accident, when the following symptoms presented themselves: there was prominence of the acromion and flattening of the deltoid; the elbow was separated from the body, to which it could not be approximated, neither could the arm be raised to the head; and, finally, there was a protuberance, evidently osseous, in the axilla. This concurrence of symptoms certainly indicated dislocation; but they are equally characteristic of fracture: and although it is true that crepitus and mobility of the fragments on each other, which are peculiar to the latter lesion, did not exist, it was possible to account for this by the interval that had elapsed since the accident occurred. On the other hand, fracture might have been produced by the blows which the patient said she had received, or luxation might equally have been the result of the fall; and the osseous protuberance in the axilla was not of the same uniform rotundity as the head of the humerus.

It will be perceived, then, that if we trust only to the rational signs hitherto adopted by every author, as the differential characters of luxation and fracture, it would be impossible, *à priori*, to form a correct diagnosis of the nature of the case in question. Nevertheless, it was determined that reduction should be attempted, care being taken to avoid any ill consequences to the patient, should it perchance prove to be a fracture: for it was necessary to bear in mind that, when the latter is treated as a dislocation, it can be reduced with certainty, but when the parts are left to themselves, displacement is soon reproduced by the action of the muscles; and that if, on the contrary, dislocation is mistaken for fracture, the reduction is rarely complete, the patient in either case being more or less crippled.

---

[1] [See foot-note at page 77. It may be remarked that the discovery of the method here attributed to Mothe is really due to Mr. White of Manchester, whose description of the mode of reduction referred to in the text preceded that of Mothe upwards of twenty years; the several dates being 1785 and 1764.—TR.]

Before proceeding to the task, the woman was prepared as is usual, especially in old dislocations, by bleeding, by the application of an opiate poultice around the joint, by baths, and by the exhibition of a few grains of the aqueous extract of opium, or an ounce of the syrup of poppies. At the first trial to extend the limb (in the manner which will be presently described), the patient screamed, and endeavours were made to turn away her attention from the operation and thus to check the resistance of the muscles, by accusing her of robbery on the night of the accident, which she vehemently denied; but in spite of this diversion, and several other attempts, the reduction was not accomplished. The flattening of the deltoid, however, was perhaps rather less apparent; which circumstance, added to the unsuccessful efforts at reduction, gave more colour to the hypothesis that there was fracture, as this altered appearance of the deltoid might be produced by the callus being forced outwards in the efforts used to extend the limb; therefore, to encourage this tendency, a lage pad was placed between the arm and the body, and the elbow was brought as near as practicable to the side by means of a roller; which treatment, however, after a trial of four days, produced no effect.

The above-mentioned case gave rise to three main questions for solution: 1st. The indications already alluded to having proved insufficient, by what means were we to arrive at the correct diagnosis? 2d. Supposing it to have been a case of dislocation, and not of fracture, the attempts at reduction by the method universally adopted having proved unsuccessful, to what means were we to resort to attain the desired end? 3d. Should the interval that had elapsed since the accident have been regarded as contra-indicating the attempts at reduction?

In consequence of the difficulty encountered, the actual condition of the joint was subjected to a more searching investigation; and at the same time Dr. Malgaigne kindly added some suggestions, which appeared so reasonable that I willingly entertained them, and the following was the result of our joint examination. In the first place, there was certainly considerable elongation of the injured limb; whereas, in all fractures of the long bones, if there is no displacement, the limb remains of its natural length; but if, on the contrary, there is displacement, with riding of the fractured extremities, the limb is shortened. In the case of this woman, the dislocated arm, from the point of the acromion to the olecranon, or to either of the condyles of the humerus, measured half an inch more than the other, which circumstance alone convinced me of the existence of dislocation, and therefore constituted sufficient grounds for abandoning the idea that the case was one of fracture. But further, Dr. Malgaigne pointed out other indications deserving of attention; and the first, a natural consequence of that already mentioned, was the elevation of the anterior wall of the axilla; and in this patient it was found that a line drawn from the inferior border of the clavicle to the lower edge of the great pectoral muscle, measured half an inch more on the affected side than on the opposite. 2dly. According to the same surgeon, the head of the dislocated bone must necessarily present a prominence anteriorly at the subclavian space, which is usually hollow, thus exhibiting a manifest difference between the two sides of the breast, especially in thin people: this was certainly very apparent in the case in question. Lastly, Dr. Malgaigne remarked that, by making pressure with the fingers immediately beneath the acromion, the deltoid readily yields in dislocations; which was very apparent in the case of this woman: whereas, in fractures, on the contrary, it cannot be thus depressed. These several signs (which are constant in dislocations and not present in fractures, and each in itself a sufficient diagnostic index) were, in combination, regarded as positively determining the existence of dislocation.

The nature of the injury being thus placed beyond a doubt, it only remained for us to ascertain whether or not the lapse of time since the accident precluded the possibility of reduction; but being convinced by experience that dislocations of much longer date may be reduced, as will be shown hereafter, I decided in the affirmative, and immediately turned my attention to the discovery of other means as an appropriate substitute for the ordinary course of proceeding, which had already failed both at Saint-Lazare and in our own hands. M. Malgaigne availed himself of this opportunity to propose a method unemployed in France, which consists in making extension whilst the arm is forcibly elevated and consequently shortened, instead of doing so when it is lengthened, and depressed. This was, in fact, applying to the present case the principle which I had adopted in all dislocations, viz. to dispose the bones in such a way that they shall ride the one on the other, and that the extension should have for its actual aim the restoration to the limb of the length which it had lost. M. Malgaigne added, that the normal and pathological anatomy of the parts concerned in these dislocations had induced him to adopt this method, before he was acquainted with the observations of White, who had formerly employed it, though exclusively in dislocations of long standing. (Gazette Médicale de Paris, September, 1832.[1]) Of its value a fair estimate may be made by its satisfactory application to the case in question: had it failed in this instance, it would have been unjust to have therefore decried it; but as the plan was successful, it is certainly entitled to some credit over and above that which belongs to the more usual method, as the latter had been already tried and found wanting.

---

[1] In 1785, Mothe, one of the surgeons of the Hôtel-Dieu at Lyons, sent to the Academy of Surgery a 'Memoir on Dislocations of the Humerus,' in which he proposed a new mode of reduction, and of which he entitled himself the discoverer. This method consists in grasping the arm at its lower extremity near to the elbow, the patient being the while seated or recumbent, and the fore-arm flexed; and then in raising the limb gradually by extending it more or less forcibly, until it is brought near to the head, that is, in a line parallel to the trunk. When this point has been gained, the extending force is augmented without changing its direction, at the same time that counter-extension is made by depressing the shoulder. Mothe cites eight cases in his memoir, in which he had reduced dislocation by this method with great ease. In four of these the injury was only of a few hours' standing; two of the patients were women, one a strong and healthy coachman, and one a new-born child, whose arm had been dislocated by the clumsiness of the midwife: in the fifth and sixth cases severally, the injury had existed twenty-four and forty-eight hours; the seventh was in a man of strong constitution, and of seventeen days' date; and in the eighth (a woman of two and thirty) the accident had occurred five weeks previously. In Germany and other parts in the North, this plan of reduction is generally associated with the name of Mothe. Rust, of Berlin, describes it in his journal (Magazin für die Gesammte Heilkunde, vol. x, p. 184).

On the 14th of August (i. e. five weeks after the accident, and eight days after the last attempt at reduction), the patient having been duly prepared, a further trial was made to reduce the head of the bone according to Mothe's method, the direction of the proceeding being intrusted to M. Malgaigne, who first proposed it. The woman was placed in a recumbent posture, and a folded sheet having been passed over the acromion, its two extremities were held firmly by assistants towards the feet; but at a later stage of the operation it was found necessary to fix these ends more firmly by passing them through a ring attached to the wall. The extending apparatus being made fast in the usual way, and intrusted to two assistants, the dislocated arm was raised as high as possible, so as to bring it almost parallel with the axis of the body, whilst it was likewise extended; the fore-arm was also pronated to render it a more direct and powerful lever, than it is when in a state of supination. The first efforts at extension appeared to produce only moderate pain; the head of the bone seemed to be completely in the hollow of the axilla, which it filled: little by little it was raised towards the glenoid cavity, and the two borders of the armpit, which were indistinguishable before, became apparent, together with the intervening fossa which they naturally bound. In the mean time pressure was made with the fingers and the palm of the hand on the head of the humerus, to assist in restoring it to its socket, at the edge of which it seemed to have arrived; twice, in this hope, was the arm brought down to the side of the body, but each time it resisted the attempt. After these failures I undertook the case in the hope that I might be more successful; I pressed forcibly with the palm of the hand on the head of the humerus, whilst the extension was still continued in the same direction upwards, and I then directed the assistants to depress the arm and carry it towards the body, but without in any way relaxing the extending force: in the first trial I was foiled, but the second succeeded completely, and the head of the bone was restored to its socket *without* *any audible noise.* The shoulder at once regained its rounded form, the elbow could be brought to the side without difficulty, the natural movements of the joint were accomplished with ease, and finally, the prominence in the axilla had disappeared. The arm when measured as before, was, however, still found to be longer than the other; and the head of the bone, as felt beneath the acromion, appeared to be a little lower than natural. It may be here remarked that the firm pressure made on the head of the bone in the axilla, certainly contributed greatly to the success of the operation.

The patient was sent to bed; a pad was placed in the axilla, and the elbow kept to the side. She did not suffer at all, and slept well. After three days the pad was removed as useless, and the only precaution taken was to retain the arm in the same position. The relation of the head of the humerus to the acromion, the trifling elongation of the limb, and the fulness around the articulation and towards the subclavicular space, all continued in the same condition as immediately after the reduction; but beyond this there was no symptom to raise a doubt regarding her ultimate and perfect cure; for there was no diminution of either sensation or motion in any part of the limb.

This was the first successful case of difficulty in which this new method was adopted at the Hôtel-Dieu. But here a natural question arises why the limb did not at once resume its normal length, when reduction was effected. Could it be that a portion of the capsule had been forced into the glenoid cavity, so as to intervene between it and the head of the bone, or was there thickening of the cartilages? I am disposed to regard the latter explanation as probable, for two reasons; in the first place, the cause which operated in producing the displacement must coincidently have occasioned some injury to the articulating cavity, by the propagation of the shock through the head of the humerus; thence would arise irritation, and even inflammation, entailing effects which, in course of time, would tend to augment the density, and produce thickening of the parts affected: but, in the second place, experience teaches us that when articulating cavities are deprived of the bones with which they are naturally associated, they gradually lose their normal character, until they ultimately become entirely obliterated. It is, therefore, not to be wondered at, that in the case before us the natural depth and capacity of the cavity was to a certain extent curtailed; the same circumstance, giving rise to a corresponding effect, has been observed in certain old dislocations of the femur after reduction: nevertheless, the explanation of M. Malgaigne is equally satisfactory. "In recent dislocations," says this surgeon, "the supra and infra-spinati muscles are applied against the glenoid cavity, and the sub-scapularis forms a sort of cap upon the head of the displaced bone: is it not a fair presumption that in course of time adhesions would be contracted, which would be rather fostered by the irritation which the fruitless efforts at reduction had kept up? Sometimes, in dissecting dislocations of some standing, we find adventitious membranes, which have assumed even a cartilaginous consistence. As to the swelling in the neighbourhood of the joint, that could not be expected to subside immediately, and it was equally diffused on all sides of the articulation; and the lengthening of the limb was regarded as an unusual condition, probably merely because it had not been before remarked, or noticed by any author." It yet remains to be ascertained whether the above condition is constant, in a greater or less degree, in all old dislocations.[1]

It was my impression that when lengthening existed, it could only be attributed to dislocation *downwards*, beneath the glenoid cavity; but M. Malgaigne was of opinion that, as the head of the humerus occupied the concavity of an arch formed by the acromion, the coracoid process and the ligament which connects them, it should evidently be at a lower level when forced beneath either pier of this arch: we therefore determined on having recourse to an experiment to decide the question. In the dry bones it was clear that dislocation under the acromion involved lengthening of the arm; but it remained doubtful whether this was the case in displacement beneath the coracoid process. The latter dislocation was produced in an arm recently prepared for the purpose with the ligaments attached; and by carefully comparing the measurements before and after the experiments, it was proved that elongation to the extent of about half an inch was the result. A further experiment was made on the same joint, having reference to the downward dislocation. When all the muscles were stripped off, it was still found impracticable to dislocate the bone in this direction, so long as the ligamentous fibres connecting the coracoid process and capsule (coraco-humeral ligament) retained their integrity; but when they were divided it was easily accomplished. But then it may be naturally asked, are these results identical with those which are usually observed in the living? The solution to this question can only be found in the dissection of suitable cases. The most remarkable point about the latter experiment is, that the amount of lengthening exceeds an *inch and a half*, which is far more than ever existed in any authenticated instance.

---

[1] [The comparatively relaxed and flaccid condition (after reduction) of the previously strained and (probably) partially lacerated capsular muscles, constitutes no unimportant item in the consideration of the phenomenon in question.—Tr.]

The preceding observations may serve to convey some idea of the many interesting questions which a careful study of these dislocations involves, and which would still well repay inquiry. Two further cases, illustrative of the same mode of treatment, may be here introduced.

CASE II. *Dislocation of the head of the humerus; reduction by Mothe's method.*—A washerwoman, aged 67, of short stature, thin, and with little muscle, fell backwards down the trap-door of a cellar which was open behind her, and rolled down a dozen steps: this accident occurred early in the morning in October 1831, and she immediately came to the Hôtel-Dieu. I ascertained that the injury she had sustained was a dislocation downwards and forwards, or beneath the coracoid process, and forthwith proceeded to reduce it. One assistant grasped the wrist of the affected arm and raised it to a line parallel with the trunk, making extension directly upwards; whilst another assistant pressed upon the scapula for the purpose of making counter-extension: I was thus left at liberty to direct the head of the bone with my two thumbs, which I did in a sitting posture. The first effort at extension sufficed to effect the reduction without difficulty, and almost without pain. The arm was brought cautiously to the side, where it was retained by the aid of a bandage; and in the course of twelve days the patient was quite well. The shortness of the patient in this instance allowed of the operation being conducted without her being recumbent: the same plan, however, may be adopted with taller persons, if the assistant who makes the extension stands on a table.

CASE III. *Dislocation of the head of the humerus; reduction by Mothe's method.*—Another woman, about 40 years of age, and likewise of meagre form, though tall, presented herself shortly afterwards at the Hôtel-Dieu, with a similar dislocation of the humerus. She was placed on her back, and a folded sheet passed over her shoulder, the ends of which were carried across to the opposite side and lower part of the trunk, and held firmly by two assistants: two other assistants elevated the arm and made extension as in the last case, whilst I pressed the head of the bone upwards with my thumbs. At the first attempt the reduction was accomplished without pain, and the patient left the hospital laughing.

In these two cases, it must be admitted, that every circumstance tended to favour the successful result, which, from the absence of muscular resistance, would no doubt have been the same, had the more ordinary method been resorted to. Nevertheless, it is but due to the plan which was adopted to remark, that the reduction was effected with unusual promptitude and facility, and without the necessity for any precaution, or preparation of the patients;—advantages which would induce me to employ the same means in similar cases. I would now direct attention to some other questions of no less importance than those which have already come under consideration.

If experience had not long since established the frequency of these dislocations, the anatomical arrangement of the joint would have naturally suggested the probability of their occurrence; for its very extended sphere of motion involves a proportionate sacrifice of its strength. The elements of this articulation are, a cavity protected by an osseo-fibrous arch, a head of bone received into this cavity, a capsule which envelops them and maintains their proper relation, and a great number of muscles which move them, (and which are of infinite importance as organs of support.) But the disproportion which exists between the dimensions of the head of the humerus and capacity of the glenoid cavity, the laxity and tenuity of the capsule, especially at its lower part, together with the position of the arm and the uses to which it is applied, exposing it continually to external violence,—all these are so many circumstances tending to favour frequent dislocation of the shoulder; and this accident would be even more frequent if the scapula, which accompanies the humerus in its (more extended) movements, did not thus act influentially in diminishing the liability to this form of injury.

The whole range of surgery scarcely presents a subject on which authors differ more than on that which has reference to dislocations of the arm: but the present is not a fitting occasion for the discussion of this question; suffice it to say, that experience and observation have proved to me that the arm may be primarily dislocated in three principal directions: 1, *downwards,* on the axillary border of the scapula; 2, *inwards* or *forwards,* in the subclavicular fossa;[1] 3, *outwards* or *backwards,* in the fossa infra-spinata. The presence of the acromion and coracoid processes, united by a strong ligament, together with the position of the scapular extremity of the clavicle, operate conjointly in preventing dislocation directly *upwards.* Nevertheless, Sir A. Cooper admits the possibility of the humerus being partially luxated in this last direction, the upper part of the capsule being torn through, and the head of the bone resting, according to his account, against the posterior margin of the coracoid process.

The dislocation of the humerus *downwards,* which is the only primitive one admitted by some authors, is unquestionably the most common; and is generally produced by a fall on the elbow, and especially on the palm of the hand, the arm being at the time extended and directly separated from the body. The humerus, therefore, immediately prior to the accident, would be so related to the glenoid cavity as to form with it an acute angle, inverted; and the head of the bone, thus gliding from above downwards, is forced violently against the lower part of the capsule, which is stretched in the opposite direction by the weight of the body, and is consequently lacerated so as to allow the head of the humerus to escape: this result is further aided by the contraction of the great pectoral, latissimus dorsi and teres major muscles. The new position assumed by the head of the dislocated bone is, on the inner side of the anterior margin of the scapula, between the subscapular muscle anteriorly and the long head of the triceps behind. The pectoralis major, latissimus dorsi, and teres major muscles act on the arm as on a lever, of which the elbow is the fulcrum, and the point of resistance is at the articulation. Dislocation *downwards* may again, according to some authors, be produced by a violent blow on the outer part of the shoulder, below the acromion: but in that case it is often complicated with fracture of the scapula or humerus. It is further possible that it may result from simple muscular action, as in the act of lifting a heavy weight, or during an attack of epilepsy; in either case a violent effort is implied, whether the effect be attributed to the agency of the deltoid in depressing the head of the bone, or, as Boyer supposes, to the action of the great pectoral, latissimus dorsi and teres major muscles, co-operating with the elevators of the arm.

---

[1] [The text has "*subscapular* fossa," which is clearly a misprint, as the dislocation under the pectoral muscle is meant.—TR.]

The symptoms of this dislocation are, lengthening of the arm, its oblique direction outwards, the separation of the elbow from the side, and impracticability of bringing it close to the trunk; the inclination of the head and body towards the affected side, the semiflexion of the fore-arm on the upper arm, the inability of the patient spontaneously to elevate and rotate the limb, and the extreme pain which accompanies any attempt to effect these movements passively; to which may be added, the deformity of the shoulder, and marked prominence of the acromion, beneath which exists a depression, dependent on the flattening of the deltoid, which is no longer sustained by the head of the humerus; whilst the latter forms a round, hard tumour in the axilla.

Dislocation *inwards* or *forwards* is the consequence of a fall on the elbow when it is separated from the body and carried backwards. The continuance of this unnatural position of the arm, the presence of a tumour formed by the head of the humerus below the clavicle and in front of the point of the shoulder, which latter is less deformed than in the preceding injury; and lastly, the impossibility of drawing the arm forwards without producing extreme suffering, constitute indisputable evidence of the existence of this form of dislocation.

It is much less frequent than dislocation downwards; and is rarely primitive, being almost always consecutive to the last-mentioned displacement.

In the production of dislocation *outwards* and *backwards*, the weight of the body would be received, as in the last case, upon the elbow, but the arm would probably be at the time carried forcibly forwards and upwards. Displacement in this direction is, however, extremely rare, and probably impossible, unless there coexist an abnormal disposition of the glenoid cavity, as, for instance, where it has an inclination backwards, and is considerably elongated. In this dislocation, the arm, but slightly separated from the chest, is directed forwards and inwards; the shoulder is simply flattened at its anterior part, and the head of the humerus forms a prominence below the spine of the scapula, towards the outer side of the anterior angle of this bone.

I have thought it requisite to enter into these elementary details, partly for instruction, but especially to place them in their proper relation with the modifications which have been proposed as supplementary to the theory that has been generally admitted, and of which the following is a summary. 1. Lengthening of the limb in the *downward* dislocation is not a recently observed fact; I have remarked its presence in all the patients who have come under my care for this accident, during my long practice: but it is another question whether this lengthening exists in every form of dislocation of the humerus, as some practitioners assert; or, on the contrary, whether the length of the limb varies, as others think, according to the nature of the displacement, in some instances being elongated, in others shortened. 2. Is there but one *primitive* dislocation of the humerus, and are the others, which have been generally admitted up to the present time, only *consecutive?* 3. If it be true that there is but one primitive dislocation, in which direction does it take place? 4. Is laceration of the capsule an absolutely essential concomitant of dislocation, or does more or less distension and stretching of this ligament suffice to allow the head of the humerus to escape from its cavity? 5. Supposing the former position to be correct, namely, that the capsule is rent, is it probable that, by its constriction around the dislocated bone, it may obstruct its reduction, as Desault thought; or, are we to hold with Astley Cooper, that this pretended obstacle is altogether imaginary? To these various queries we have still to add the diversity of opinion which exists, even in reference to the anatomical structure and arrangement of some of the parts which constitute the uniting medium of the components of the joint; whence arise the different explanations which are given regarding the mechanism and frequency of displacement of the humerus. It is thus that some, in whose opinion I have always coincided, maintain that the lowest part of the capsule is the weakest, and that dislocation downwards is therefore the most frequent; whilst others aver that the capsule is stronger here than at any other point, and place the axillary dislocation, in point of frequency and facility of occurrence, in the third class of displacements of the head of the humerus. It would be no difficult matter for me to solve most of the preceding questions by reference to my own personal experience; but this would involve too lengthened a discussion, and I shall have to recur casually to several of these points, in the course of the succeeding inquiries and narration of facts.

It has been generally asserted that in the orbicular articulations dislocation is always *complete;* but pathological anatomy has disproved this dogma, by presenting us with examples of *partial* luxation of both the femur and humerus.

CASE IV. *Partial dislocation of two orbicular articulations; the anatomical characters associated therewith.*—In 1824, the surgeon in chief of one of the Paris hospitals presented to the Academy a pathological specimen taken from a man who died eight months after suffering from a dislocation of the humerus, which had not been reduced. It exhibited a false joint, formed on the one hand by the glenoid cavity of the scapula and a small portion of the surface of the ribs, and on the other by the head of the humerus, which was grooved to receive the anterior border of the glenoid cavity, the two surfaces being thus locked together, so as to constitute a sort of hinge-joint. During life the only motions which could be performed were in a direction from before backwards, and that to a limited extent. In a case of spontaneous luxation of the femur, the same surgeon found the softened head of the bone resting on the anterior border of the cotyloid cavity, and there firmly locked as in the preceding case. These, then, are two well authenticated instances of partial dislocation of the two orbicular articulations, the improbable occurrence of which had led all authors to deny the possibility of their existence.

CASE V. *Dislocation of the upper extremity of the humerus, with fracture of the greater tubercle.*—As the opportunities of examining the scapulo-humeral articulation after recent dislocation are rare, on account of the simple accident itself never proving fatal, it is important to avail ourselves of the occasion of so doing when it happens to present itself. A man was attacked with cerebral hemorrhage, brought on by a fall, which at the same time occasioned dislocation of the arm: he was brought to the Hôtel-Dieu in February, 1830, and died there shortly afterwards. The scapulo-humeral articulation was carefully dissected, and exhibited the following appearances. There was a large rent in the lower part of the capsule, close to its insertion into the anatomical neck of the humerus: the head of the bone passed freely through this opening, and could be restored without difficulty to its normal position: the external tubercle of the humerus was fractured and detached from the rest of the bone.

The practical inferences to be deduced from the above case include, in the first place, the fact that the lacerated aperture in the capsule is not necessarily so narrow as to offer any serious obstacle to the reduction of the head of the bone. Desault was so strongly persuaded of the existence of this difficulty that he took measures to extend the opening, hoping thereby to facilitate the reduction: for this purpose he employed passive motion to a considerable extent, in spite of the severe suffering it occasioned to the patient, and doubtless, in some instances, with the effect of setting up serious mischief. Without denying the probability of the rent being in some instances narrow, I am far from believing that it constitutes so common an obstacle to the reduction of dislocation as Desault appeared to think it did. The fracture of the greater tubercle of the humerus also merits attention: it appeared to have resulted from the powerful resistance offered by the tendon of the infra-spinatus muscle; and may be compared to the tearing away of the inner or outer malleolus, which is occasionally witnessed in the several dislocations of the foot inwards and outwards. The bones, under these circumstances frequently offer less resistance than the fibrous tissue of the ligaments and tendons, and their disintegration is the consequence.

I have already pointed out the symptoms which are peculiar to each form of scapulo-humeral dislocation, and have directed attention to the fact that these symptoms equally characterize fracture of the upper extremity of the humerus; so that in many cases the difficulty of distinguishing these different injuries is such as to lead, not uncommonly, to a false diagnosis. In every instance of dislocation, or fracture of the upper extremity of the humerus, it is found that the patient has fallen on the injured side of the body; but the position of the limb is not the same in the two accidents, and this difference is generally sufficient to decide the character of the lesion which follows, and furnishes a clue to the diagnosis. If the arm is separated from the body and in this position it be extended forwards or outwards, so as to break the fall, dislocation without fracture would be the probable consequence. But if, on the contrary, the fall take place when the arm is by the side, as, for instance, in the breeches-pocket, and no effort is made to raise it, the momentum and weight of the body might be received on the point of the shoulder, and the resulting injury would most likely be a fracture of the head, or upper part of the humerus. In either case the pain experienced at the shoulder is severe, and gives rise to the impression in the patient's mind that he fell on that part. This point, however, may generally be ascertained by examining the palm of the hand, which is usually soiled and excoriated when it is the part which first reached the ground: and there is similar local proof, when such is the case, of the shoulder being the part struck: the negative evidence must also be taken into consideration in either instance. In dislocation the pain is referable to laceration of the fibrous capsule and neighbouring tissues; in fracture it is due to contusion of the shoulder, and such injury as the soft parts may have received from the fractured extremity of the bone.

Ecchymosis may be, and indeed commonly is, one of the consequences of these lesions; but as it is produced, in dislocation, by the laceration of some of the internal parts of the joint, and i [illegible] contusion of the external parts of the shoulder, the seat of this ecchymosis is entirely different in the two cases; in the former it is diffused over the anterior and internal part of the arm, whilst in the latter (fractures) it is limited to the prominence of the shoulder itself: lastly, its presence is more uncommon in dislocation, but almost constant in fracture. In both of the above injuries the acromion is prominent, and the deltoid is flattened; a void is perceived on its inner side, and there is a corresponding projection in the armpit: but an accurate analysis of these symptoms almost always dispels any doubts which may have arisen from a superficial examination. In fact, the evidence in question is more marked in dislocation than in fracture, the deltoid rather appearing as if shortened and puffy in the latter injury. Again the prominence in the axilla is very marked in dislocation, but much less apparent in fracture; it is moreover rounded in the former, but of an irregular form in the latter. All these points of contrast spring from the fact that the displacement is always more complete in the one than in the other form of lesion.

The absence of crepitation and the immobility of the arm are negative evidence of dislocation, as the reverse condition is a positive sign of fracture. Indeed, where there is dislocation of the humerus, if the limb be moved the upper arm appears to be entire, and the scapula is even carried with it, as if they constituted together one continuous body. But in fracture there is an unnatural mobility about the upper extremity of the bone, usually accompanied by crepitus, which is most readily detected by grasping the lower extremity of the arm, and rotating it on its axis. Lastly, the most distinguishing point of contrast between dislocation and fracture is, that much greater force is required to reduce the former, and that the only after-treatment called for is the precaution of keeping the arm to the side; whereas, in fracture, the employment of a suitable apparatus is indispensable, in order to preserve the accurate adjustment of the fragments, and to prevent the muscles from reproducing the displacement; if this be neglected, a cure without deformity or constraint of movement can scarcely be anticipated.

Sometimes it happens that when the fracture consists in a simple solution of continuity, without displacement, it is mistaken for a severe contusion of the shoulder. The crepitus and mobility which are felt when the humerus is rotated, are then the sole means of solving the doubt. It is, however, important to avoid being misled by a species of crepitation or crackling sensation which may be present where the injury is only a severe contusion, and which is attendant on the defective secretion of synovia, resulting from inflammation of the articular surfaces: the following case is illustrative of the false diagnosis alluded to.

Case VI. *Fracture of the neck of the humerus mistaken for a contusion.*—Julien Marcelin, aged 36, a mason, of powerful frame, was thrown from a cart which he was driving, and pitched upon his left shoulder: sharp pain and a powerless condition of the arm were the immediate consequences of the accident. He applied for advice at the hospital of St. Louis, where the symptoms were attributed to a contusion, and the shoulder was leeched and poulticed. As no benefit resulted from this treatment, the patient came to the Hôtel-Dieu a week afterwards, where the error was soon detected, by rotating the arm whilst one hand was placed firmly on the shoulder; crepitus and abnormal mobility were thus rendered apparent even to the bystanders. As the patient was very tractable, it was decided that the fracture should be treated by simple position: the arm was placed, semiflexed, and a little separated from the body, on a pillow; and a band was fastened to it, so as to keep the shaft of the bone in contact with the upper fragment; another band supported the wrist, to prevent the patient from moving the extremity. In less than a month he left the hospital well; union was complete, and without deformity, and all the ordinary movements could be performed perfectly, with the exception of elevation, which was still a little cramped.

Case VII. *Fracture of the upper extremity of the left humerus mistaken for a contusion.*—Eugène Maxime, a jeweller, aged 49, was admitted into the Hôtel-Dieu in November 1821. He had fallen on his left shoulder a week previously; severe pain succeeded the accident, accompanied by total loss of power in the extremity, and considerable swelling shortly afterwards made its appearance. These symptoms were treated as if indicating a simple contusion; but no benefit being derived from the remedies employed, the patient applied for advice at the Hôtel-Dieu. At first sight the signs of fracture were not very evident; but on rotating the arm from the elbow, crepitus was very distinct. As there was no displacement the treatment was very simple: the same means were resorted to as in the last case, to keep the arm in proper position and at rest; and the patient left the hospital well, at the end of five weeks.

CASE VIII. *Fracture of the neck of the humerus, with slight displacement of the head of the bone, simulating luxation.*—An old soldier, aged 62, fell whilst walking down hill; and the left upper extremity, which was at the time close to the side, received the whole weight of the body. When brought to the Hôtel-Dieu on the day following that on which the accident happened, there was considerable swelling about the scapulo-humeral articulation, with shortening of the deltoid; this muscle was, however, somewhat increased in thickness and breadth, but yielded slightly under pressure: the other symptoms were, prominence of the acromion, more marked than in ordinary cases, with indistinct crepitus and very obscure mobility of the fragments of the broken bone on each other; a globular tumour in the hollow of the axilla, very much resembling the head of the humerus, and a fulness at the internal part of the shoulder, under the great pectoral muscle; in addition to which it was impracticable to bring the arm close to the side. With such a concatenation of symptoms it may be readily conceived how difficult it was to arrive at a just diagnosis. I concluded that the case was one of fracture, and treated it accordingly. A suitable apparatus was applied, but after the lapse of two days the swelling increased, and it was noticed, in dressing the patient, that the deltoid had diminished in thickness, and was neither so wide nor shortened as it at first appeared to be; it could, moreover, be distinctly pressed inwards, and there was a hollow beneath the acromion, which latter was prominent; lastly, the absence of all mobility at the supposed seat of fracture, and the presence of a perfectly rounded body in the axilla made me doubt the correctness of my former impression.

The limb was extended, and a cushion, which entirely filled the axilla, was adjusted as in the treatment of fracture of the clavicle: the lower part of the arm was then fixed to the side by a roller carried several times round the body, and drawn tightly; this had the effect of throwing the inferior extremity of the humerus forwards and inwards, whilst its upper part was directed backwards and upwards, and rested upon the axillary cushion. Five days subsequently the surrounding swelling had almost entirely disappeared; crepitus could be distinctly felt and heard, and the fractured extremity of the shaft of the bone could be felt in the axilla, presenting considerable inequality of surface, and apparently made up of several pieces slightly movable on each other. There could, therefore, no longer remain any doubt as to the correctness of the first opinion, especially as the head of the humerus could be also distinguished in the fore and upper part of the axilla. The apparatus was renewed from time to time, and at the expiration of six weeks it was entirely removed: the mobility and crepitus had then quite disappeared; the limb had resumed its natural length, and the deltoid and acromion their normal state and position.

Case IX. *Fracture of the upper part of the humerus resembling dislocation.*—S. J. Lebby, aged 70, fell on her shoulder, in October 1823, and presented herself at the Hôtel-Dieu three days afterwards. The arm was then swollen at its lower part, the deltoid was flattened, and the acromion prominent; whilst the cavity of the axilla was occupied by a tumour which might readily be taken for the head of the humerus. Deceived by the report of the house-surgeon, I at first supposed the accident was a dislocation; but a careful examination proved it to be a fracture of the upper extremity of the humerus, with displacement of the head downwards and inwards. A suitable apparatus was applied and kept on for rather more than two months, after which the patient quitted the hospital cured; the shoulder having resumed its normal form and mobility.

Case X. *Dislocation of the right humerus upwards and forwards, consecutive on dislocation inwards; reduction.*—— Hamlin, aged 26, an engraver, whilst walking hastily on the roof of a house five stories high, to render assistance during a fire, fell into the court-yard below, encountering in his fall a wooden fence eight feet high. When brought to the Hôtel-Dieu, (in January, 1817,) he was labouring under several severe contusions, and his right arm was dislocated: the arm was laid on a pillow, lotions applied to the shoulder, and the patient bled. As he lay on his back on the following day, with the arm extended on a pillow, it was separated from the body, so as to form a right angle with it, the limb being in an extreme state of supination. There was no sensible prominence in the axilla; but on carrying the hand inwards beneath the pectoral muscles, the head of the humerus could be distinctly felt at only a few lines distance from the clavicle. When the arm was brought near to the body, whilst the patient was in a sitting posture, prominence of the acromion and slight flattening of the deltoid were perceptible, such as attend dislocation below the clavicle. When the whole limb was moved, great pain was occasioned: a globular tumour was further apparent below the clavicle, by which the pectoral muscles were raised. Lastly, the patient was unable to perform the ordinary movements of carrying the arm backwards, to the head, &c. These symptoms were interpreted as indicating a dislocation forwards and upwards, consecutive on dislocation inwards. The patient was again bled for the purpose of reducing the general powers, and thus facilitating reduction.

On the following day, before proceeding to the operation, I remarked that the reduction would probably be attended with considerable difficulty, as the man was strong, robust, and muscular; and that, moreover, this form of dislocation was more troublesome to reduce than the displacement downwards or inwards. This proved to be the case, as the reduction was not effected until after the employment of considerable and long-continued extension, during which the attention of the patient was diverted as much as possible by frequent and pressing questions. The arm was immediately bound to the body, in a semiflexed position, and was retained thus for twenty days, after which permission was given to the patient to begin to move the limb; but it was a long time before he regained the perfect use of it.

Sometimes dislocation of the humerus is complicated with fracture of its surgical neck; and this is one of those uncommon injuries in the treatment of which nature and art are of little avail: but, though thus powerless, it is very desirable that the surgeon should form a correct diagnosis, in order that a suitable apparatus may be employed.

CASE XI. *Dislocation of the humerus complicated with fracture of the neck, mistaken for a simple dislocation; ineffectual attempts at reduction.*—A cooper, aged 43, of powerful frame, in the act of mounting a ladder insecurely fixed against a door, fell into the opening, dragging the ladder itself with him. It was impossible, from the account of the patient, to ascertain exactly how the accident occurred, as he can only recollect that his left arm was entangled between two of the rounds, one of which pressed the shoulder with great force inwards; that he experienced severe pain in the scapulo-humeral articulation at this moment, with a sensation as if something had been torn; and that he then fell on his left side. A village-surgeon was called in, who, taking it for a simple dislocation, had recourse to repeated extension, and then applied the usual bandage: and it is worthy of record, that during the continuance of the extension the patient experienced marked relief: the probable explanation of this is, that the fractured ends of the bone were thus adjusted, and no longer irritated the surrounding soft parts. After twenty days of perfect rest the patient perceived no amelioration in his symptoms, the shoulder being still deformed and the arm unnaturally long; whilst any attempt to move it occasioned excessive pain. Nevertheless, he did not seek for any further advice until fifty-five days after the accident; and the symptoms which then presented themselves were the following.

The left arm was longer, by at least an inch, than the right; the movements backwards and forwards were very restricted and rather painful; and although the limb was nearly parallel with the thorax, very acute suffering in the upper and fore part of the shoulder was occasioned by any attempt to bring them into actual apposition: adduction was both very limited and painful. The shoulder was sensibly flattened, but did not present the same appearance of depression as in simple dislocation: the acromion was prominent. The abnormal direction of the humerus was readily detected by the eye, but determined with still more accuracy by the touch; for, instead of terminating superiorly beneath the acromial arch, the upper extremity of the shaft inclined inwards, and became united with the upper fragment, at an angle, in the axilla: whereas, the head of the humerus lay immediately beneath the acromial extremity of the clavicle, where it projected in a very marked degree, so as to raise the deltoid border of the great pectoral muscle. If slight pressure was made with the thumb on this prominence, and directed from above downwards, motion was imparted to the entire arm.

Some attempts at reduction were made by the house-surgeon on the day that the patient was admitted, but they were wholly abortive; some baths and poultices somewhat mitigated the pain which the slightest movement occasioned. I at once stated that I did not entertain the least hope of accomplishing the reduction of the dislocation, although it was probable that the callus which united the fracture had already become perfectly solid: and I had not forgotten the instance in which a surgeon of eminence had bitterly repented having yielded to the solicitations of his patient. The only rule of conduct to be adhered to in this unfortunate complication is, to counteract the tendency exhibited by the broken extremities of the bone to assume a position internal to that which is natural to them. In cases where it is impracticable to distinguish between fracture and dislocation, the following direction will be found practically valuable, as an aid in forming a correct diagnosis: restore the limb, by suitable measures, to its normal form and length, and then leave your patient for seven or eight hours; if, at the end of that time, you find the shoulder deformed, you may rest satisfied that the case is one of fracture.

The fifth of the preceding cases has exemplified how difficult it is at times to distinguish even a recent dislocation from a fracture of the humerus. I cannot, however, say that the error is one of frequent occurrence, except amongst ill-instructed and unobservant practitioners; and this should stimulate all who are studying surgery to make themselves acquainted with the positive and precise characteristics of each of these lesions. We have frequently received into our wards individuals, in whom fractures or dislocations have been mistaken by the medical men who sent them, although the distinctive characters of the accidents were well marked. But in dislocations of long-standing, the differential signs which have been enumerated are often by no means so easily recognized, of which the first case is a convincing illustration. The symptoms which are peculiar to fracture may have disappeared, even supposing them to have been previously present; there remain, therefore, the symptoms common to both of the injuries, with the superaddition of those which belong especially to dislocation, and which the lapse of time has not obliterated. It is on the latter that the greatest reliance must be placed in these intricate cases, and amongst them the following deserve especial attention; viz.: 1. Increased length of the arm, a sign the importance of which has not hitherto been duly appreciated. 2. Increased depth of the anterior wall of the axilla. 3. Deformity of the shoulder, and the facility with which the deltoid may be depressed by the fingers. As to the projection which is met with in front, beneath the coracoid process and great pectoral muscle, and which is independent of the bony prominence in the axilla, it should not have more weight than it is really entitled to, as it is observed in instances where fracture is accompanied by slight displacement of the bone, of which the fifth case in the present chapter is an exemplification.

CHAPTER V.

CASES OF FRACTURES OF THE CLAVICLE AND UPPER EXTREMITY OF THE HUMERUS, TREATED BY POSITION.

For some years past the treatment of fractures has undergone a salutary reform, in which the semiflexed position unquestionably occupies a prominent place. This method of treating fractures, which was first employed exclusively for the lower extremities, I have since introduced as likewise applicable to the upper, after having rejected in some instances the clavicle apparatus of Desault, as that surgeon had previously cast aside those of Ledran, David, and Moscati. It is, however, but justice to Desault to bear in mind that he was the first to establish the principle, that it was not sufficient to draw the external fragment outwards, but that it was further necessary to raise it in order to replace it on a level with the inner fragment. It was upon this idea that he constructed an apparatus tending to combine the fulfilment of these two indications. But the arrangement of Desault was not without its drawbacks. A great many patients could not support the constriction of the chest which it involved, without experiencing a sense of suffocation more or less distressing. In other instances, this pressure occasioned inflammation, and even sloughing, but almost invariably it was attended with intolerable pain.

In order to obviate these inconveniences I dispensed with the application of the apparatus for fractured clavicle; and in cases of diseased lungs or heart it is especially contra-indicated. If, in cases of fracture of the clavicle, the patient be placed in the horizontal posture, with the arm on a pillow, the necessary indications may be fulfilled by preventing the weight of the body from having any influence, and thus the tendency even to displacement downwards is precluded. The following cases will serve to exemplify the simplicity of my treatment.

Case I. *Fracture of the right clavicle, treated by position, and united without deformity at the end of thirty-two days.*—Marguerite Guillemon, aged 48, was admitted into the Hôtel-Dieu in 1827. She had fallen out of bed on the right shoulder, and the consequence was a fracture of the clavicle at its centre. The characterizing symptoms were pain, deformity, mobility, crepitus, and difficulty in moving the arm: the sternal fragment constituted an irregular, angular prominence beneath the skin, whilst the acromial fragment lay below it. The reduction was easily effected by seizing the arm at its upper part and drawing the shoulder outwards. A pillow, in the form of a cushion, was placed between the arm and the trunk, the former being fixed in a semiflexed position on the pillow: some compresses, steeped in vegeto-mineral water were placed over the seat of fracture, and kept moistened every evening.

On the following day the fragments were found to have preserved their exact relation; the patient was very well and free from pain. On the fifteenth day there was some swelling of each fragment at the seat of fracture (from the deposit of the callus): and on the thirty-second day the union was complete. The patient soon after left the hospital.

Case II. *Double fracture of the clavicle, treated by position, and cured in thirty-two days.*—J. Thérèse Fagot, aged 70, was admitted into the Hôtel-Dieu in 1827. This patient also fell out of bed on her right shoulder, which she struck against a night-table, the consequence being a fracture of the clavicle. The symptoms were, severe pain, swelling about the middle of the right clavicle, a violet tint of the skin at the seat of fracture, and angular prominence of the outer fragment: an inch farther outwards, there was a second but less marked prominence, and distinct crepitus at each of these points: the movements of the arm were constrained and painful; and the limb itself was carried in front of the body. The reduction was effected by carrying the shoulder outwards; the arm was then extended, separated from the body, and placed in a semiflexed position on a pillow. The same local application was employed as in the last case.

On the following days the fragments were in proper apposition: but on the fifth day the scapular extremity was a little displaced, which was remedied by gentle pressure: and from this time forward the patient went on well. On the thirty-second day union was complete, there remaining only slight deformity at the point above named, and the swelling evidencing the deposit of callus.

CASE III. *Fracture of the neck of the right humerus, treated by position, and united at the end of a month.*—Marie-Anne Baudord, aged 63, was admitted into the Hôtel-Dieu in 1827, having, two days previously, fallen from a height on some wood, with the right arm extended forwards. The accident was accompanied by acute pain in the limb, which she was unable afterwards to move; and in a short time considerable swelling extending as high as the shoulder made its appearance, and the arm was numbed. The patient passed a restless night and came to the hospital on the following day.

When admitted, the arm, shoulder, and the fore and upper part of the chest were swollen, tense, and livid; she complained of acute pain at the shoulder, and a sense of numbness in the whole limb, which remained powerless. On examining the axilla no prominence could be detected; but when one hand was placed on the deltoid whilst the arm was rotated with the other, distinct crepitus was elicited, accompanied by pain referred to the highest point of the bone.

The treatment consisted in placing the arm, semiflexed, on a pillow between it and the trunk; the pillow being arranged so as to form a pyramid, the summit of which was lodged in the axilla: the upper part of the limb was covered with a moistened compress, and the elbow-joint fixed by fastening a bandage around it and across the bed, by which arrangement the shaft of the bone was likewise prevented from being carried upwards and inwards. In ten days the swelling had entirely subsided; and on the twentieth the presence of callus was apparent. On the twenty-fifth union appeared to be complete; and a few days afterwards the patient got up and carried the arm in a sling. Shortly afterwards she left the hospital quite cured, and beginning to use the arm.[1]

---

[1] [Considering the age of the patient and seat of the fracture, the progress of the above case seems to have been unusually rapid, and should be therefore scarcely regarded as a precedent in the treatment of similar cases. The same remark applies equally to the next case.—TR.]

Case IV. *Fracture of the neck of the left humerus, accompanied by fracture of the leg, and cured at the end of a month by position.*—Françoise Despaux, aged 66, was admitted into the Hôtel-Dieu, with fracture of the left leg and arm; which was produced by her falling from a sink raised about four feet from the ground: she was immediately brought to the hospital. After the broken leg had been attended to, I examined the left shoulder, which was the seat of acute pain; and detected a fracture of the neck of the humerus, which was rendered apparent by crepitus, and the presence of an irregular, angular prominence in the axilla. Reduction was effected by drawing downwards the lower part of the arm, whilst the body was fixed; the further treatment corresponded to that of the last case. On the eighth day there was not the slightest displacement of the fractured extremities of the bone; and on the twenty-eighth union appeared to be complete: that portion of the deltoid which corresponded to the seat of injury was firm and resisting. Ten days subsequently the fracture of the leg was united, and the patient left the hospital at the end of the seventh week.

Instead of displacement, some cases of fractured clavicle present a simple curvature, which has been attributed by some distinguished surgeons to incomplete fracture; an opinion which the following case does not seem to confirm.

Case V. Boutit, an apprentice boy, aged 15, was playing at a game with several of his companions, which consists in one boy leaning forward whilst his companions in succession leap on him (saute-mulet.) Boutit was thus leaning upon a small stone mantle-piece, with his hands resting on the top of it, and had already received two of his companions on his back, when a third, in attempting to jump on the other two, overthrew them: in order to avoid the fall they kept their hold of Boutit, who staggered and fell against the side of the mantle-piece, the fore and outer part of his right shoulder striking the corner of it. He immediately experienced a sharp pain, and was unable to move his arm in various directions without suffering.

On the second day after the accident I saw this patient in the hospital, [illegible] a curvature of the clavicle, with its convexity [illegible] but the shoulder retained its natural configuration. On the following day M. Pelletan saw the boy, and on perceiving the curvature just mentioned, he proceeded to rectify the deformity by placing the left hand behind the right shoulder, and the palm of the right hand before the clavicle, and then endeavouring to approach them to each other. At the first effort a distinct snap was audible to many of the pupils; and when the clavicle was again carefully examined it was found to be fractured, but the two fragments continued to support each other. A bandage was applied; and on the fourth day there was some swelling about the middle of the clavicle, but no pain. At the end of a month the union was complete.

There are other causes, besides those already enumerated, which contra-indicate the use of the fractured-clavicle-apparatus, such as severe contusion of the chest attended by extravasation of blood beneath the skin, and broken ribs. I may, lastly, illustrate the importance of attention to this point by noticing a case to which I was lately called. A man had fractured his right clavicle, and the surgeon who was first called in thought it requisite that the patient should lose blood, and accordingly bled him in the arm of the injured side. Soon afterwards a troublesome venous hemorrhage came on, which could not be arrested; and when I was summoned I merely removed the apparatus (the pressure of which was the cause of the mischief) and placed the arm on a pillow; the bleeding immediately ceased.

CHAPTER VI.

ON FRACTURE OF THE INFERIOR EXTREMITY OF THE HUMERUS, RESEMBLING DISLOCATION BACKWARDS. DISTINGUISHING CHARACTERISTICS OF THESE TWO LESIONS. RARE CASES OF DISLOCATION.

It is impossible to insist too strongly on the importance of attention to the diagnostic signs by which fractures and dislocations are distinguished; for we daily meet with instances in our hospitals which have baffled the sagacity and observation of even talented surgeons. It is thus that affections of the ilio-femoral articulation, scapulo-humeral dislocations, fractures of the lower extremity of the humerus and radius, and in short all solutions of continuity in the neighbourhood of joints are the sources of numberless errors.

There is nothing so common as to see a fracture of the lower end of the humerus, immediately above the elbow-joint, mistaken for a dislocation backwards: it is, nevertheless, of the last importance to distinguish between these accidents, as a false diagnosis necessarily entails a permanent and incurable deformity. Let us suppose a case of transverse fracture through the humerus immediately above the condyles; the olecranon is drawn backwards and upwards by the triceps, and the fractured extremity of the shaft of the bone is carried forwards, simulating the lower articular surface of the humerus. The prominence formed by the olecranon is so marked that, in comparing the two joints, this apophysis on the injured side is found to exceed that of the sound side by a space of from twelve to eighteen lines: lastly, the antero-postero diameter of the arm near to the elbow is sensibly augmented; and thus you have in appearance all the signs of a dislocation. If this impression is acted upon, extension and counter-extension are employed, and reduction is generally accomplished with very little difficulty: a bandage is [illegible] the operator plumes himself on the facility with which he has arranged matters. But a very short time elapses before the displacement is reproduced; and in the course of five or six days, in the midst of the swelling, something which is not very like the natural relation of parts is felt. This accident is generally attributed to the patient, who is accused of being intractable: the reduction is again effected, but the deformity speedily reappears, and considerable swelling then supervenes. As long as this condition lasts, and the real state of the joint is thereby masked, the surgeon continues ignorantly secure, and a month, or perhaps six weeks or two months elapse before he discovers the error he has committed, and then the mischief is irreparable; the patient never recovers free and perfect motion of the limb. Indeed, for the most part, if twelve or fifteen days pass over without the real nature of the injury being detected, it is too late to do anything for the patient; for the swelling of the neighbouring parts constitutes an almost insurmountable obstacle to complete reduction, and the deformity is consequently incurable.

CASE I. *Fracture of the lower extremity of the humerus mistaken for dislocation of the elbow; and consequent deformity.*— In the latter end of 1832 a young child was brought to me who, a month previously, had fallen whilst in the act of getting on a donkey. Two doctors were successively called in, who pronounced the case to be one of dislocation, and treated it accordingly. When I saw the child's arm there was an irregular tumour in front, which was evidently the lower extremity of the humerus; and the olecranon formed a prominence behind. It is very likely, from the tender age of the patient, that there was separation of the epiphysis; the two fragments were united, but with deformity. What was the proper course to pursue? I dreaded the consequences of rupturing the callus; and remarking that inability to extend the fore-arm was the principal inconvenience attending the bad union, I recommended the employment of an apparatus by which the arm might be extended by degrees; but at the same time I gave it as my opinion, that there would always be some deformity, and that motion would be limited.

The principal sign by which fracture may be distinguished from dislocation is crepitus. If then the surgeon is summoned soon after the occurrence of the accident, he should examine the limb, by grasping the upper arm in one hand, and the fore-arm in the other, and then moving them upwards and downwards, or backwards and forwards on each other; in this way the crepitus which characterizes fracture is almost always elicited. It may also be remarked, that very moderate force is generally sufficient quickly to restore the parts to their natural relations: although it must likewise be admitted that, of all dislocations that of the elbow is amongst the easiest to reduce, and requires the least force for that purpose.

The valuable sign of which I have been speaking (crepitus) is often very much masked, or even entirely hidden, by the presence of swelling. Thus, it is true, the reduction of the displacement is always easier than in dislocation, and the mobility greater. But who would venture to give a decided opinion under these circumstances? Fortunately we have one available resource, a pathognomonic sign or test, which may stand in lieu of crepitus; it is this. Grasp each of the fragments with one hand, the thumb being applied in front and directed towards the fracture, and in this manner attempt the reduction: this simple effort is alone sufficient, for the most part, to effect it; especially if the experiment be made in the course of the first twenty-four or thirty-six hours after the accident. When the reduction is thus perfectly accomplished, move the fore-arm backwards; if the case be one of dislocation it continues reduced, but if a fracture the displacement is reproduced immediately.

M. Malgaigne, who has published some observations on this species of fracture, is of opinion that other diagnostic signs may be added to those which have been already enumerated. In dislocations, says he, the articulation is destroyed, and flexion or extension are impracticable; whereas in fracture it is intact, and these movements are probably in part preserved. This test can only be brought to bear within a short time after the receipt of the injury: but whatever time may have elapsed, there is an anatomical sign which cannot mislead, and which is as infallible as the relative anatomy of symmetrical parts can make it; viz. whatever may be the prominence of the olecranon posteriorly, it is never further removed from the tuberosities of the humerus than in its natural relation to them; but in dislocation this separation is very apparent. Moreover, in the latter case the anterior prominence is more rounded, and less broad; whilst, in fracture, it presents as great a lateral diameter as the joint itself. If, which it is difficult to imagine, the swelling be such as entirely to mask the natural prominences of the bones, it would be probably of little importance then to form a correct diagnosis, and the deformity itself would most likely not be recognizable.

CASE II. *Fracture of the lower extremity of the humerus, simulating dislocation of the elbow backwards; cured without deformity.*—D., aged 27, tall and powerfully made, fell into a ditch on his left elbow; and came at once to the hospital to be treated (as the surgeon whom he consulted had decided) for dislocation of the elbow. On admission, the elbow-joint was deformed, and the lower part of the arm was enormously swollen, tense, and painful: the fore-arm was semiflexed. On examining the tumour, notwithstanding the tension, a hard prominence was perceptible, which was rough and slightly irregular, and occupied the bend of the elbow, so as to raise the brachialis anticus and biceps muscles: posteriorly the olecranon could be felt projecting beneath the skin, and was drawn up to a little above the level of the condyles: flexion and extension were utterly impracticable, and any attempt to move the fore-arm in either of these directions was attended with excruciating pain. Thus far the signs might be supposed to correspond with those which might be looked for in a case of dislocation: but, when the lower extremity of the arm and upper part of the fore-arm were moved on each other in contrary directions, an abnormal mobility and distinct crepitus were perceptible. This left no doubt upon the subject, and I pronounced the case to be one of fracture of the lower end of the humerus, some fingers' breadth above the condyles. All the signs which resembled dislocation were easily explained by the seat of the fracture: for, the continuity of the humerus being broken, its lower articulating extremity no longer presented their natural support to the radius and ulna, and the olecranon process was consequently drawn upwards by the tonic contraction of the triceps. Moreover, this change of position (which alike accounted for the prominence of the olecranon behind, and the forced semiflexion of the fore-arm) also involved the relation which the fractured extremities of the humerus presented: for the intimate union of the articulating portion of this bone with that of the ulna, naturally caused it, by a sort of see-saw effect, to be directed forwards, and thus occasioned the projection of the lower fragment beneath the flexor muscles of the fore-arm.

On the day that the above accident happened it was found impracticable to obtain entire reduction, on account of the pain which the attempt produced, and especially in consequence of the great swelling. I was, therefore, obliged to place the arm, semiflexed, on some pillows which were placed horizontally; and directed that the affected parts should be kept wet with Goulard's wash. The patient was also largely bled, and low diet and an anodyne draught prescribed.

On the next day I completed the reduction in the following way: the shoulder of the patient being fixed, an assistant was directed to draw downwards the semiflexed fore-arm with one hand, at the same time making pressure at the bend of the elbow with the other; I then grasped with both hands the lower part of the arm on a level with the fracture, and forced the olecranon forwards and the inferior fragment backwards. The reduction being thus accomplished, the arm was again placed on pillows as before: some graduated compresses were applied around the lower extremity of the arm, so as to correspond to the two osseous prominences, and to replace the fingers, by the pressure of which they had been forced into position. Support was also afforded by two long compresses, and other parts of the apparatus which had been prepared by being wetted with a solution of acetate of lead in cold water. Lastly, the two lateral pads were folded on themselves at their lower extremity, so that in tightening the apparatus the splints might be forced against the graduated compresses, and thus press in opposite directions the olecranon process and the upper extremity of the lower fragment.

On the second day the apparatus only required a little tightening: but on the sixth the patient began to complain of a return of pain, and on unbinding the arm it was found that the fragments were a little displaced. A little extension soon affected the reduction, and the apparatus was immediately reapplied. Fro [illegible] d the progress of the case was favorable; the arm was examined from time to time, but the parts continued in accurate apposition. On the thirty-third day the apparatus was finally removed, there being a good union, unattended by deformity; and on the forty-fifth, D. left the hospital, having already acquired considerable power in flexion and extension of the joint.

CASE III. *Fracture of the lower extremity of the humerus, mistaken for a dislocation of the elbow.*—The child of Madame M. fell on the left elbow, and the surgeon who was first called pronounced that he had dislocated the fore-arm backwards. The joint was restored to its natural condition by attempts at reduction, but the deformity speedily reappeared. Another surgeon was asked to see the child, and he also thought there was dislocation, and took him to Paris. On hearing the history of what had occurred, I was of opinion, before I saw the case, that the accident was a fracture. A consultation was held, at which I met two other surgeons, who both considered the case to be one of dislocation; but I had no doubt about the existence of fracture, and the treatment of the child was intrusted to me. The fracture was reduced and the same course pursued as in the last case; on the thirty-second day the young patient was quite cured.

CASE IV. *Oblique fracture of the left humerus at its lower part, near to the elbow-joint; with signs of luxation of the elbow backwards. Reduction of the fracture, and cure in fifty-four days.*—P., aged 23, a healthy young woman, was admitted into the Hôtel-Dieu in 1821, in consequence of having sustained an injury at the lower part of the left humerus, near to the elbow: there was considerable displacement and a wound on a level with the olecranon. The accident was caused by a fall backwards on the pavement, and was attended at the time with acute pain, followed by immediate and total loss of power in the limb.

From the character of the deformity the first impression might very naturally have been, that there was a dislocation of the elbow; for the lower fragment was drawn backwards and very much upwards, so as to resemble the upper extremity of the bones of the fore-arm; whereas, the upper fragment of the humerus, descending very much in front of the lower, constituted a prominence in this position, such as is met with in cases of dislocation of the elbow backwards. The limb was, moreover, shortened and every kind of motion was impracticable. But the mobility of the fragments, the crepitus, and above all, the integrity of the articulation at the elbow, soon cleared up any doubts, which might otherwise have existed, as to the nature of the injury. The fracture traversed the bone obliquely about an inch above the articulation; and the wound which existed behind was produced by contact with the ground, and did not communicate with the fracture. Nevertheless, the case was considered a serious one, as inflammation might be propagated to the joint and lay the foundation of great mischief.

The reduction of the fracture was effected by means similar to those which have been already detailed in the second case, and the natural form of the joint was thereby restored. The same form of apparatus was likewise employed; and the wound being dressed, the arm was laid in a flexed position on a pillow. A copious bleeding was ordered, and absolute rest enjoined: low diet and an anodyne draught were also prescribed. This treatment was persevered in for some days and with the happiest effects; the patient suffered little, and no untoward symptom made its appearance: the wound soon healed, and at the end of forty days the union of the fracture seemed to be firm, and without any apparent deformity. On the fifty-fourth day the patient left the hospital perfectly cured, and had already recovered considerable power in the use of the arm.

Case V. *Fracture of the lower extremity of the humerus.*—A young woman, 26 years of age, was thrown down, and brought to the hospital in 1827. The accident was attended by severe pain in the elbow, and succeeded by inability to move the arm. On the day of admission (the third after the accident) the following symptoms presented themselves: the right arm was shorter than the left, and slightly flexed; but any attempt to flex it still further occasioned acute pain. There was some swelling about the joint, but not sufficient to preclude [illegible] The olecranon projected upwards and backwards, which accounted for the diminished length of the humerus. In front of the joint there was a prominence, covered by the brachialis muscle and tendon of the biceps, which were stretched and tense. When the arm was grasped with one hand and the fore-arm with the other, and then moved in contrary directions, an obscure crepitus was felt, as well as a mobility which, under the supposition that there was dislocation, would imply laceration of all the articular ligaments. On these two symptoms especially the diagnosis was formed; and I proceeded to reduce the fracture in the way already described, viz. by pressing the lower extremity of the humerus and the olecranon in contrary directions, whilst extension was made at the wrist. For the purpose of preserving the accurate adjustment of the fractured ends, thick pads were placed over the olecranon and inferior extremity of the humerus, and fixed by a bandage: over this again other pads were placed, the object of which was to force backwards the lower fragment, and especially to press downwards the olecranon, and thus counteract the power of the triceps; and, lastly, some long splints were applied and fixed with tapes. The apparatus was removed after twenty-four hours, to see that the various parts answered the purpose required of them, which was found to be the case; and the patient recovered, without a single drawback, in the usual time.

From the preceding cases we learn the importance and diagnostic value of crepitus, as elicited by the means described in the detection of fracture of the lower extremity of the humerus. If, however, the swelling and inflammation of the affected parts be such as to preclude the practicability of a sufficient investigation, or if it be impossible, even with such examination, to determine the nature of the injury, it is then most prudent to treat the case at once as fracture: and even should it be discovered, after the lapse of some few days, that there is dislocation, it is not too late to employ the appropriate remedies, and the patient will have lost nothing by waiting. The case which has been supposed is not of that class which admits of hesitation, as delay would be fatal to the cure, and deformity would result in either instance.

I have been in the habit of employing the form of pressure described in the last case, where a fracture is attended with much displacement, and even after the callus has attained a certain amount of solidity. In very oblique fractures of the tibia, do what one will, the union is frequently attended with curvature, which may be in great measure obviated by the means alluded to, viz. counter-pressure directly applied upon the salient extremities of the fracture.

Having thus pointed out the diagnostic signs by which fracture of the lower extremity of the humerus may be distinguished from dislocation of the elbow backwards, I proceed by the following cases to exemplify the latter form of lesion, in order the more clearly to contrast the characteristics of the two injuries. Two of the cases will be found to present other points worthy of remark, in respect of the diagnosis and character of the displacement.

Case VI. *Dislocation of the left fore-arm backwards, produced by a fall on the palm of the hand; reduction and cure.*—Charles Dieux, aged 32, a cabriolet driver, of good constitution, fell whilst in the act of getting down from his box. The palm of his left hand struck the ground with violence, and sustained nearly all the shock of the fall. The pain he experienced was but trifling; nevertheless, after the lapse of six hours, there was such an amount of swelling, that the surgeon who was first consulted could not detect the injury: he therefore contented himself with the application of a lotion to the elbow. On the following day leeches were applied, but the swelling did not begin to subside until the ninth or tenth day; and the dislocation was not recognized until the fifteenth. When at last the true nature of the lesion was ascertained, the patient was recommended to apply for assistance at the Hôtel-Dieu.

At the time of his admission the following appearances presented themselves. The patient carried his fore-arm almost completely extended, and supported it, as it hung by his side and a little in front of the body, by a long sling. He affirmed that this had been the position of the arm ever since the accident, and that any attempt on the part of the surgeon to flex it had been met with great resistance, and had occasioned much suffering: this condition remained unchanged; indeed the resistance was greater than ever, as the parts had evidently become adherent in their new relations. The relative position of the articular extremities of the humerus, of the radius, and of the ulna were very much altered; yet on simply viewing the elbow which, it is true, was still swollen, it would have been difficult to guess that such displacement existed: it was the extended state of the fore-arm (peculiar to this form of dislocation) together with the slight swelling around the joint that still remained, which masked the altered relation of the bones. But, when the joint was carefully examined, the olecranon could be felt projecting backwards, and above it there was a very manifest depression, two circumstances which are never observed in extension of the undislocated fore-arm. Posteriorly there was another prominence, formed by the head of the radius, which was external and a little inferior to the olecranon. Thus, the extremities of the two bones of the fore-arm constituted an osseous mass behind the joint.

The following signs indicated that the lower extremity of the humerus was carried forwards. There was, in the first place, a superficial osseous resistance at the bend of the elbow, which marked the presence of this bone: in the next place, the internal and external condyles could be distinguished, each occupying a position anterior and a little inferior to the prominences formed by the olecranon and radius. Lastly, a very good method of distinguishing these different bony projections, and of ascertaining the reality of the abnormal relation which the articular surfaces have assumed, is to place the thumb of the left hand on the outer condyle, and the fingers on the inner condyle; and then to grasp with the right hand the osseous mass behind, and so move these parts on each other in a transverse direction. In this way it is easy to detect the separation of the parts in question, and thus to identify them.

Having in the present instance satisfied myself of the existence of dislocation, I did not hesitate to promise the patient a cure: and ordered that the elbow should be enveloped in a large poultice until the reduction was attempted. On the eighteenth day after the accident the patient was brought into the theatre and seated in a chair, in the same position as for reduction of a shoulder dislocation; the same apparatus for extension and counter-extension were also employed. I placed myself on the outer side of the arm, and then directed that extension should be made in the axis of the limb. After this had been continued for a short time, an articular crepitus, a sort of rubbing sensation, was felt both by myself and the assistants, which proclaimed the reduction: at the same moment, before the extension was relaxed, I flexed the fore-arm on the upper-arm, and thus satisfied myself of the return of the parts to their normal relations. The evidence of this fact was the restored motion of the joint; the disappearance of the various prominences and the depression which have been noticed as characterizing the dislocated joint; and lastly, the suspension of the mobility in a transverse direction, of the radius and ulna on the humerus.

The patient was placed in bed with the fore-arm semiflexed, and all the limb equally supported by a pillow: a lotion was applied to the elbow. Trifling swelling supervened, but unattended with pain; and it disappeared in the course of a few days. The same position was maintained for a week, when he was allowed to get up with his arm in a sling. Passive motion was shortly afterwards commenced, and he could soon move his arm without pain; when he left the hospital the power of the limb was nearly restored.

Case VII. *Dislocation of the fore-arm, primarily backwards and consecutively outwards.*[1]—Louis Vincheron, aged 22, a druggist, of bilious temperament, had got on a barrel to reach something, and slipped by placing his foot on a piece of damp wood: he thus lost his equilibrium and fell on his right side, in such a way that the overturned barrel pressed on his hams and bent his body forwards: the right arm being at the same time directed forwards, reached the ground in a state of extension, and thus had to sustain the whole weight of the body: dislocation of the elbow was the consequence. Some ineffectual attempts at reduction were made on the spot; and the patient was admitted into the Hôtel-Dieu two hours after the accident. This occurred in November 1807.

When I saw this patient in the evening, the injured limb was separated from the side; the fore-arm was semiflexed, and in a state of pronation, and it was impossible to supinate, or entirely to extend or flex it. The outer and lower part of the upper-arm seemed to be driven in, as if there were fracture of the lower part of the humerus above the condyles. Lower down there existed a considerable prominence at the outer and upper part of the fore-arm: the limb appeared to be shortened. At the lower and inner part of the upper-arm there was another prominence, formed by the lower extremity of the humerus which was carried inwards: its inner tuberosity was very distinct, being covered only by skin. The humerus was entire. The olecranon, which was driven outwards, appeared to rest on the outer condyle, its natural position being occupied by the triceps muscle: the above process of bone was vertically beneath the acromion. The posterior extremity of the pulley of the humerus projected beneath the skin; and the head of the radius was carried forwards in front of the outer tuberosity of the humerus. The distance between the inner tuberosity of the humerus and the olecranon was fully two inches. There was no evidence of fracture of the fore-arm; but there was considerable swelling, although only five hours had elapsed since the occurrence of the accident.

---

[1] This dislocation, when seen, was outwards and forwards; but one would suppose it must have been in the first instance backwards, as it would be difficult to conceive how otherwise th [illegible] of the fore-arm had attained the former position.

The humerus being fixed as well as the trunk, and the lower part of the arm supported, I took my position on the outer side of the limb, and seized the fore-arm at its upper and outer part, at the same time grasping the lower and inner part of the humerus. I then fixed the latter, and forcibly drew the radius and ulna outwards. On the first effort the ulna was incompletely replaced; but on the second, which was aided by simultaneously supinating the whole fore-arm, it was entirely reduced. The elbow-joint could then be extended, but the motions of flexion and supination were still imperfect.

The radius now remained to be reduced. Its head formed a prominence, above which was an obvious depression at the point where it should be in relation with the head of the humerus. A third effort was therefore made, during which an assistant extended and supinated the fore-arm, whilst I forcibly pressed the head of the radius outwards: incomplete reduction was in this instance likewise effected, and on further extension the latter bone also resumed its normal position. The movements of flexion and supination were then also restored; but some crepitus was distinguishable when the arm was thus exercised, and on placing my finger on the upper extremity of the radius I could detect the tendency which still existed to displacement. I therefore directed that a roller should be applied on the hand, that the fore-arm should be semiflexed and prone, and that the head of the radius should be supported by a graduated compress; and these precautions were adhered to as long as the patient remained in the hospital. In the evening an anodyne draught was administered, and low diet was prescribed. It should be observed that the patient was bled immediately after the reduction.

After so important a dislocation, and the complicated and severe treatment it entailed, there was some reason to apprehend extreme swelling of the limb, if not gangrene; but these anticipations were not realized. A trifling and superficial ecchymosis manifested itself at the spots which were most contused, but this soon disappeared; and after a fortnight's repose and care, the patient went out quite well, and able to move his arm in various directions. He was recommended to be cautious in the exercise of the limb, and to continue for a time the use of the bandage.

I saw this patient some months afterwards, and the only peculiarity which I remarked was, that the radius could not be very distinctly felt at its upper part: there was a trifling fulness about the joint. Some of the movements of the fore-arm were still a little cramped and limited, but no pain was experienced: he employed himself as usual, and was even able to lift heavy weights with the limb without inconvenience.

Case VIII. *Double dislocation of the right elbow, of several years' standing.*—Louis A. Beaudry, an ostler, aged 32, was admitted into the Hôtel-Dieu in 1813. Whilst in the act of putting by a carriage he fell with the whole weight of his body on the right elbow. He experienced severe pain at the moment, which obliged him to quit his work. On the following day there was considerable swelling round the elbow-joint, accompanied by almost entire loss of motion; and on the second day these symptoms being aggravated he came to the hospital. When I examined the limb, the fore-arm was semiflexed on the upper-arm, the hand prone, and the elbow deformed and larger than the opposite: at the lower and back part of the upper arm an osseous prominence, an inch or an inch and a half in extent, could be felt through the swelling of the soft parts. A hard, oblong tumour, placed transversely and deeply under cover of the muscles at the bend of the elbow, occupied the anterior and inferior part of the limb. Extension was impracticable, and flexion very limited. The aggregate of these signs left no doubt in my mind of the existence of dislocation backwards: but on continuing the examination of the elbow-joint I discovered that, besides this, there was a dislocation outwards. The external tuberosity of the humerus was buried in the soft parts; and the upper extremity of the radius, which was carried outwards and slightly forwards, had quitted the smaller head of the humerus. The inner tuberosity formed a considerable prominence on the inner side of the elbow, and an interval of about an inch existed between its summit and the inner side of the olecranon. On carrying the finger along this interval it was very easy to distinguish the hollowing out which the posterior part of the articular pulley on the humerus presents. There evidently existed, therefore, a double dislocation in the same joint, one backwards and the other outwards.

Having thus ascertained the nature and extent of the mischief, the next point to learn was, whether it resulted from the recent fall, or was the consequence of a previous one; information which it is very necessary to obtain in these cases, though not always so easy of acquisition. Indeed, one often meets with patients who do all in their power to deceive those who are anxious to be of service to them: some act thus in the hope of being cured of a long-standing affection, which they affirm to be recent; whereas, the fear of the suffering, which the efforts at reduction necessarily involves, prompts others to assert that a recent deformity has existed for a long time, by which they entail upon themselves a maimed condition for the rest of their lives. Lastly, there is a third class of persons whose intelligence is so limited, that it is impossible to ascertain from them whether they had ever received any injury prior to that for which they sought admission into the hospital. The patient who was the subject of this accident belonged to the last category; for it was not till after he had been repeatedly questioned for two days, that we could learn from him that the dislocation of his elbow had existed many years. He told us that he had been a soldier, and that, at the battle of Austerlitz, his right arm had been broken at its lower part by a piece of artillery passing over it, and that he had ever since been maimed: this indeed obtained for him his discharge. There was, consequently, no attempt made to reduce the dislocation: appropriate remedies procured an abatement of the swelling and other symptoms arising from the recent injury, and he soon left the hospital as well as before the accident.

The succeeding cases, although not positively belonging to the subject under consideration, bear in some respects upon it; and likewise offer other points of sufficient interest to make them worth narrating.

Case IX. *Spontaneous dislocation of the upper extremity of either radius; deficiency of the lower extremity of the ulna.*— Josephine Michon, aged 14, of stunted growth, came to the Hôtel-Dieu, in 1817, to obtain relief for a pain in the foot, &c. On examining the elbow and wrist-joints the following appearances presented themselves. On the *left side* the upper extremity of the radius was dislocated backwards on the humerus, and was convex instead of being concave, forming beneath the skin a prominence of an inch or more. The articulation of the radius with the hand presented no peculiarity. The upper extremity of the ulna was also in a normal condition; but on carrying the finger down along this bone, it could not be felt below; it was evidently curtailed of at least three inches of its length. In consequence of these conditions, the upper extremity of the radius formed a prominence when the fore-arm was flexed or extended on the upper-arm; but this was especially apparent in flexion. The patient had not, however, lost the power of rotating the fore-arm; only the hand was unsteady and bent inwards when pronated or supinated. Flexion and extension of the hand were also easily performed, but still with the same inclination towards the ulnar border of the fore-arm.

On the *right side* the fore-arm presented, at its upper part, an analogous disposition to that of the left. At its inferior part the radius was natural; but the ulna, on the contrary, was rugged and irregular, and it was not difficult to detect traces of a fracture near the carpal extremity of this bone, which had united unevenly. The little patient said that she had twice sprained this wrist.

Independently of the above peculiarities in this child, the extremities of all the long bones were enlarged; but the spine was not deformed. Her parents said that up to seven years of age she was robust and well-formed; but that since that period, her limbs have been gradually assuming their present condition: there was no trace of open abscess around any of the joints.

CASE VII. *Double congenital dislocation of the upper extremity of the radius on the humerus.*—In 1830, M. Loir gave me an anatomical preparation, exhibiting dislocation of the upper extremity of the radius on the humerus on both sides of the body. The abnormal position which the head of either radius had assumed, was at the back part of the lower extremity of the humerus, beyond which it extended for the space of at least an inch. This disposition of parts was absolutely identical on the two sides, and had all the characters of a congenital affection. I once before saw a similar case, about five and twenty years ago.

Such a condition as the above may result from violence or disease: and a very probable effect would be a state of forced pronation of the fore-arm. It has been said, and the celebrated Cooper has himself remarked, that fracture of the lower extremity of the humerus is much more frequent in children than in adults or old people: it is, however, apparent from the above instances, to which many more might be added, that this lesion does occur at later periods of life.

I will conclude with a few remarks on the proper course to be adopted in such complicated cases as have been narrated. When a surgeon is summoned to a patient who has signs of fracture of the lower extremity of the humerus, or of dislocation of the humero-cubital articulation, he takes the upper-arm in one hand and the fore-arm in the other, and, if the case is one of fracture without much swelling, the parts are readily restored to their natural relations; but the slightest movement of the limb by the patient reproduces the displacement either forwards or backwards. There need be no hesitation then in arriving at the conclusion that the deformity is consequent on fracture: and I again repeat that, where there is a difference of opinion regarding the nature of the lesion, the decision should be to treat the injury as a fracture; for the only inconvenience which can result in such case, even were the diagnosis incorrect, would be that of wearing the requisite apparatus longer than is essential; whereas, inevitable deformity would be the consequence of treating a fracture as a dislocation.

The proper mode of conducting the treatment of these fractures has been already illustrated in the foregoing cases; I will now recapitulate the various steps in detail. After extension and counter-extension have been made, and accurate coaptation of the fractured ends of the bone has been obtained, the limb is to be placed on a plane of pillows previously arranged with the suitable apparatus; the position of the arm should be intermediate between flexion and extension. Graduated compresses are then to be laid on the anterior and posterior surfaces of the humerus; they should be of about the breadth of three fingers, not more than three or four inches long, and a little thicker opposite the fracture than elsewhere: over these two splints are to be placed, one posteriorly which should press on the olecranon so as to force it forwards, and the other anteriorly which ought to be so arranged as to make pressure on the displaced extremity of the humerus. With the same view a transverse compress is to be added, the centre of which should embrace the olecranon, and the two ends be crossed in front of the arm. A many-tailed bandage is next to be applied, and over it a folded cushion, which is destined to support the lower end of the humerus; a similar arrangement is adopted for the olecranon: in this way the humerus is pressed backwards and the olecranon forwards. Lastly, a short splint is placed over each cushion, and the tapes which confine them are sufficiently tightened to produce the desired effect. In the course of twelve or fifteen days there is no longer any risk of the fragments becoming disturbed, for the tumefaction in the surrounding parts is a safeguard against consecutive displacement. Thus, the swelling which, in a case of fracture mistaken for dislocation, is the great obstacle to reduction after a few days have been allowed to elapse, becomes, if the diagnosis prove correct, a very useful auxiliary in the cure.

CHAPTER VII.

ON FRACTURES OF THE LOWER EXTREMITY OF THE RADIUS, RESEMBLING DISLOCATIONS OF THE WRIST.

Almost all authors who have written on dislocations of the wrist, have described as many as four kinds; and the only point in which these writers at all differ from each other is respecting the number. J. L. Petit was the first author who entertained any rational notions concerning the disastrous consequences of supposed dislocations of the wrist when negligently treated, and the proper treatment to be resorted to in such cases. Pouteau, in a memoir specially devoted to fractures of the fore-arm consequent on falls, has this remarkable observation: "These fractures are most frequently taken for sprains, for incomplete dislocations, or for a separation of the ulna or of the radius at their junction near the wrist." Desault also noticed fractures of the lower extremity of the radius, and even published several cases, commenting on the fact of their having been *sometimes* mistaken, by inattentive surgeons, for dislocations of this bone.

One would have thought that the observations of these writers would have raised some doubts in the minds of modern surgeons on this obscure point of doctrine: but not so; for we find Richerand, Boyer, Delpech, Léveillé, Monteggia, and Samuel Cooper adhering to the old errors; and they have unanimously admitted four dislocations at the wrist, giving their symptoms, and describing the appropriate treatment. I have for a long time publicly taught that fractures of the carpal end of the radius are extremely common; that I had always found these supposed dislocations of the wrist turn out to be fractures; and that, in spite of all which has been said upon the subject, I have never met with or heard of, one single well authenticated and convincing case of the dislocation in question.

I have also stated that, in all the wrists I had dissected with this view, I had never met with a dislocation as the consequence of a fall on the palm of the hand; and that the only instances of this injury which I had seen were those in which it was consecutive on disease, or symptomatic of other lesions.

As to the frequency of fractures of the radius at its lower part, I apprehend there are no longer two opinions, whatever may be thought of the impossibility, or at least extreme rarity, of dislocations: it is this latter point of doctrine which I propose to discuss and place in its true light in giving a history of these fractures.

One of the first remarks which fracture of the lower extremity of the radius suggests is, its analogy to similar solutions of continuity near the tibio-tarsal articulation. As in fractures of the radius, the hand is much abducted, the ulna very prominent, and the lower part of the radius itself very depressed; so, in fractures of the fibula, the foot is everted, the tibia very prominent, and the lower part of the fibula equally depressed; and muscular action in each instance aids in producing the deformity. This conformity in a pathological point of view is striking, in comparing generally the upper and lower extremities: thus the shoulder and os inominatum correspond, as do likewise the arm and elbow with the thigh and knee; and the patella, though loose, is evidently the analogue of the olecranon. There are points of marked resemblance likewise between the fore-arm and leg, though here the points of contrast are also striking. In the fore-arm, the two bones possess neither the strength, length, nor volume of those of the leg, because the former are organs of motion only, whilst the latter are likewise organs of support: in the former there is also an especial arrangement of the articulations to allow of supination and pronation of the hand. The contrasted development of the radius and ulna above and below equalizes their power of resistance, or nearly so, throughout: but in the leg there is no analogy in this respect; for the tibia is the principal bone both at the knee and ankle-joints, and the fibula acts only a subsidiary part even below. Thus, if an individual falls on the foot, the shock is sustained by the tibia, which may be broken without necessarily involving the fibula in the mischief: or if external violence be inflicted on the upper part of the tibia, the fibula may be unaffected by it. But, it may be naturally remarked, the fibula is often fractured: true, and this is how it happens: either a foreign body acts directly on the bone itself, or the foot is violently twisted inwards or outwards, as in a sprain: in these two ways only can fracture of the fibula occur.[1]

These points of analogy and contrast being established, let us now consider what consequences may result from this arrangement of the bones of the fore-arm. Suppose an individual to be walking and to step on a pebble or some such obstacle in his way, (which is what occurs in the majority of cases); he trips and falls forwards, the hands being instinctively extended to break the violence of the concussion and protect the face; and if the extension of the joints is complete, the entire shock, augmented by the acquired momentum, falls on the bones. Two things may happen under these circumstances: the fall may be on the extremity of the fingers, which may thus be more or less strained; but, as the fingers are weak, they readily yield, and transmit the shock to the carpus and metacarpus, where it is distributed on account of the number of articulations which constitute the connexions of these parts: but sometimes either the phalanges or metacarpal bones are broken. If, however, instead of falling on the fingers, the supposed individual should fall on the wrist, then the result is different: sometimes there is dislocation of the upper-arm; in other instances the elbow suffers; but in the majority of instances, there is fracture of the lower extremity of the radius; and the injury falls on this bone rather than on the ulna, because it is broad and articulates directly with the carpus, and thus opposes the greatest resistance to the shock.

The radius was, therefore, properly denominated by the ancients "*manubrium manûs*;" for it is the principal support of the hand, and with it the upper surface of the first row of carpal bones almost exclusively articulates: it is the lower extremity of this bone which sustains all the violence resulting from contre-coup, which is the consequence of a fall on the anterior part of the wrist: it is not, then, astonishing that fracture should occur at this spot. But, it may be said, how is it that a bone of tolerable magnitude does not offer resistance? it is because there is no part of the skeleton which will not give way under a fall, the rapidity of which is so much augmented by the weight of the body: to which we may add, that the lower extremity of the radius is spongy and soft, and is the point at which all the violence of the shock is concentrated.

---

[1] [The author seems in this place to have overlooked a third and very frequent mode in which the fibula is broken, viz. consecutively on fracture of the tibia; and this may take place opposite to, or at a distance more or less removed from, the primary fracture.—Tr.]

In addition to the reasons which I have just given in explanation of the frequent occurrence of fracture at the lower extremity of the radius, others may be adduced which are equally important in a surgical point of view. In examining the structure of the soft parts, one cannot fail to perceive that it is not the ligaments which prevent the displacement of the articular surface forwards, but that this effect is especially due to the multitude of flexor tendons, deprived as they are at this point of all the fleshy parts, and reduced to the simple fibrous tissue which composes them. These tendons are bound together beneath the anterior annular ligament of the wrist; and thus offer so efficient a resistance that severe falls are insufficient to tear them through: the hand is forced into a state of extreme extension, and the tendons are firmly applied on the anterior part of the radio-carpal articulation. If the extension is still further augmented, the wrist-joint is yet more closely clasped by these parts, and their power of resistance is incalculable: I am convinced that a force equivalent to two thousand pounds weight would be inadequate to overcome it; and the known power of the tendo achillis is sufficient to prove that this computation is not exaggerated.

The risk of dislocation backwards by a fall on the dorsal surface of the hand is equally precluded by the tendons of the extensor muscles. Their arrangement and relations at the back of the joint are similar: it is true they are not quite so strong; but we must admit that their power of resistance is very considerable, when we take into consideration how they are inclosed in sheaths as they cross beneath the posterior annular ligament of the wrist. I have not alluded to the ulna, for it has really little or nothing to do with these movements, as it does not articulate (directly) with the hand. To sum up then;—the extreme rarity of dislocation forwards or backwards is owing to the obstacles opposed by the flexor and extensor tendons.

I have said that I have never witnessed a dislocation of the wrist, and that, on the contrary, I have found fractures of the radius very common: the following statistical account of the cases admitted into the Hôtel-Dieu will confirm my statement. In 1829, of one hundred and nine fractures treated in the hospital, twenty-three had their seat in the fore-arm, viz. sixteen of the radius, five of both bones, and two of the ulna. In 1830, of ninety-seven fractures, twenty-two belonged to the fore-arm, sixteen being of the radius alone, and fourteen of this number affecting its lower extremity; in four instances both bones were broken, and in two the ulna only. This proportion has been even greater in other years.

Fracture of the lower extremity of the radius is met with at all periods of life: of the fourteen cases which were collected in 1830, the age of the youngest subject was eight, and that of the oldest eighty-eight: moreover the two sexes seem equally obnoxious to this injury. It would probably be more interesting to ascertain which side is more frequently affected, but our statistics are not sufficiently extensive to settle the question. Of the cases referred to nine were fractures of the right radius, and seven of the left; whilst those of the ulna and of both bones were equally numerous. The right side seems to be in general more frequently the seat of fracture; for, of ninety-seven cases, fifty-nine were on that side. As to the causes of fracture of the radius, three of the number were produced by falls on the back of the hand, and the remaining eleven by falls on the palm: M. Cruveilhier was, therefore, wrong in supposing that the radius could not be broken by the former accident. The opinion of Pouteau, who attributed this fracture to the spasmodic action of the pronator muscles when the hand reached the ground, seems scarcely to call for a serious refutation.

As we have now seen why fracture of the lower extremity of the radius is so common, the next point for consideration is the seat of this lesion. Although by no means invariably the case, yet generally it will be found that the bone is broken near to the wrist-joint: but in young subjects separation of the epiphysis is more likely to occur than fracture, as I have seen in many instances. The fracture may be transverse or oblique, and at a distance of six lines, an inch, or an inch and a half from the articulating extremity of the bone: but the nearer the fracture is to the joint, the more closely does the consecutive displacement resemble an actual dislocation. In some cases I have found a comminuted fracture, a sort of crushing of the lower end of the radius. Several fractures, when they radiate, may then be observed on this part of the bone: the injury takes a long time to cure, and there is often considerable swelling at the lower part of the fore-arm, with limited motion and deformity. In general, however, fractures of the lower extremity of the radius have an oblique direction from above downwards and towards the palmar aspect of the arm. Nevertheless, they may take an opposite direction; and we shall see further on how this operates on the displacement of the fragments.

Hitherto I have only spoken of fractures which are consequent on the contre-coup occasioned by falling on the palm of the hand; but they may also result from falls on the back of the hand as has been already noticed, although these cases are comparatively rare: when the accident occurs in this way the shock is no doubt received on the first row of carpal bones, and transmitted directly to the lower end of the radius.

Before I made known the frequency of these fractures, and caused a change in the established opinions on this point of doctrine, some considered the lesion to be a sprain; whilst others, amongst whom was Boyer, ranked it with dislocations. I have already shown the fallacy of these conclusions and their inconsistency with facts: but I do not mean to deny that a fall on the front of the wrist may produce a simple contusion of the joint, attended by violent distension of the anterior radio-carpal ligaments; this, however, is a very different thing from dislocation. A case of this sort occurred in a female who was admitted into the hospital in 1829, and I treated it by applying the ordinary apparatus for fracture of the fore-arm; this measure being, according to my experience, the best adapted for the cure of affections resulting from distension of the ligaments, as it ensures better than any other perfect immobility, which is the most important indication to fulfil.

But let us dwell for a few moments on the two opinions to which I have alluded. As regards dislocation I can only state my belief that no external force can act upon the radius and ulna so as to produce this form of injury: but the alternative of a sprain calls for a more careful investigation, as it is more closely allied to fractures of the lower part of the radius. It is, in fact, the primary effect of the causes which produce these fractures: and, even admitting the possibility of dislocation of this bone, a sprain must likewise in this case be the first effect. When a person falls on the inner or outer side of the palm of the hand, and fracture of the radius is not the consequence, there may still be distension of the anterior carpal ligaments: for although these are numerous they are not very strong, their deficiency in the latter respect being supplied by the flexor tendons. Distension of the ligaments frequently occasions acute pain, which prompts patients to seek for medical advice. At a later period considerable swelling makes its appearance anteriorly, when the hand has been bent backwards, or all these symptoms are referred to the dorsum of the wrist when the fall is on the back of the hand: for in these cases, as in sprains of the foot, the symptoms and sufferings are referred to the side of the limb which is opposed to that towards which it has been twisted: thus, if the foot is turned outwards the sprain is on the inner side, and vice versa. So it is with the hand; extension of the wrist results from a fall on its palmar surface, and the converse. The sprain may, however, be likewise either internal or external, when the fall is on the outer or inner side of the hand, severally as the case may be.

The sprains which affect the front or back of the wrist are the most common and also the most serious. The pain is usually transient, but it is often followed by tension and inflammation, which may terminate by suppuration within the thecæ of the tendons, and between the vessels. The danger attending inflammation is great, as it is almost always accompanied by strangulation of the part; but the consequences of suppuration are still more serious, on account of the depth at which the matter forms, and the important parts which are involved.

Sprains are not to be feared in their acute stage only, for they may entail symptoms of a more chronic nature, such as those which characterize white swellings. Indeed, if this class of diseases be carefully investigated and traced to their true source, it will be found that they are for the most part referable to straining of the ligaments as their primary cause; and a scrofulous diathesis contributes very much to this termination of the form of injury alluded to. Since, then, sprains, whether in their acute or chronic stage, involve such disastrous consequences, they should be treated with decision and promptitude. If there is much pain general bloodletting should be had recourse to, aided by leeching, with resolvent and sedative applications: the latter indication is well fulfilled by the saturnine lotion. The pain readily yields to time and these remedies; and the patient, under the fallacious impression that the danger is past, speedily begins to use the injured limb. It is this error which is attended with such fatal results, giving rise to slow, insidious inflammation, terminating in the white swelling, for which we are so often obliged to have recourse to amputation. When the pain has subsided, the proper treatment is to keep the articulation in a state of perfect immobility; in fact to employ the same means for securing entire rest, as if the case were one of fracture of the lower end of the radius: and should fresh symptoms of inflammation arise, antiphlogistic measures must be again resorted to for their removal. When the inflammation has passed into a chronic stage, counter-irritants in the form of blisters, cautery, moxas, &c., must be had recourse to; with the precaution of still enjoining perfect rest, which is indispensable. The justness of these precepts, as applied to injuries at or near the wrist-joint is evident, when we take into consideration that, whether the case be one of simple sprain, of dislocation (which I do not admit), or of fracture of the lower extremity of the radius, adequate support and perfect repose are indications which should be fulfilled in either case: this rule does not admit of an exception.

Usually fractures of the lower end of the radius are simple, but sometimes they are comminuted: I have seen some specimens in which the lower fragment was split vertically into two portions. M. Flaubert, surgeon-in-chief to the Hôtel-Dieu at Rouen, showed me, in 1832, the radius of a mechanic who, after a fall on the wrist and foot, died of diseased liver: this bone was broken about six lines above the joint; the styloid process was detached and drawn up; and from the centre of the articulation a radiating fracture extended in various directions. A specimen which I now have by me is another illustration of what I said respecting the crushing of the bone. In some rare instances, fracture of the radius is complicated with compound dislocation of the ulna, of which the following singular case is an example.

Case I. *Double fracture of the radius, with compound dislocation of the ulna; excision of protruding bone, and incomplete cure.*—B., a portress, aged 62, short and thin, was admitted into the Hôtel-Dieu in 1832. On the previous evening she had tripped and rolled down about sixty steps; but she could not say in what way her fore-arm struck the ground: the ulna projected outwards. A surgeon who was called in placed the hand on a splint and dressed the wound. When admitted into the hospital on the following day, her left fore-arm was deformed near the wrist, with a re-entrant angle on the radial side: the radius was broken in two places, one fracture being about an inch above the joint, and the other an inch and a half higher up. On the inner side was a longitudinal wound, corresponding to the margin of the ulna and about four inches in length, with clean edges, as if the injury had been inflicted by a cutting instrument. The ulna, which was dislocated inwards, protruded to the extent of more than an inch through the skin. The internal lateral ligament was ruptured, and the muscles and other soft parts were more or less torn and contused. There had been a good deal of blood lost by the wound, the arm having been tightly bandaged without any attempt at reduction; and the hand and lower part of the fore-arm were very much swollen.

Seeing such extensive mischief M. Breschet proposed amputation; but as the patient obstinately refused to submit to the operation, he determined to remove the extremity of the ulna, which was at once accomplished in the following way. Having detached the soft parts which were still adherent to the bone, he inserted a slip of pasteboard beneath it, and then sawed off about an inch and a half of its lower extremity. The fore-arm was forthwith restored to its natural direction, and was simply dressed and placed on a wooden splint: a spare diet was enjoined. In the course of four days suppuration was established, and the swelling was considerably diminished. Three days afterwards some sloughs separated; and it was found necessary to counteract, by pads on the radial side of the arm, the tendency of the radius to slip out of place: for the broken portions were quite movable on each other.

Everything now went on well for some days, until swelling appeared on the back of the hand, which was at first thought to be œdematous; but on careful examination fluctuation was detected, and a considerable quantity of matter was evacuated by an incision: the wound was poulticed. Nothing further occurred for several days except an obstinate diarrhœa which it was difficult to arrest.

Towards the close of the fourth week the whole of the fore-arm as high as the elbow was red, tense, and swollen, and presented here and there points of fluctuation: some small sacs of matter were opened on the dorsal aspect of the arm, and the swelling soon subsided. Again the patient appeared to be going on favorably, and again she was thrown back, about a fortnight afterwards, by fresh swelling and a fresh accumulation of matter on the dorsal surface of the fore-arm: an incision was made as before, and a poultice applied. A further threatening at a later period fortunately subsided without the formation of another abscess. The fractures of the radius gradually united, and the patient began to regain some command over her fingers. In this way, sometimes improving, at others losing ground, she continued in the hospital for four months longer, and then went out, with the wounds at the lower part of the fore-arm not yet healed.

After remaining at home for some time these wounds appeared to heal, but they re-opened; and in less than three months after quitting the hospital M. Malgaigne saw her, and found two fistulous openings near the inner side of the wrist, at the bottom of which the denuded ulna could be felt. The injured fore-arm, which was deformed and seamed with scars, was an inch shorter than the other, and the motions of supination and pronation were entirely lost: the fingers also were stiff and inflexible, and the wrist-joint was not in much better condition. The patient also suffered considerably when there were changes in the weather.

CASE II. *Fracture of the lower extremity of either radius.*—

A woman, aged 58, of small stature, and a water carrier by occupation, was admitted into the hospital in March, 1834. Fifteen months prior to the above date she was under treatment in another hospital for fracture of the right radius. Whether it was that the nature of the injury was not detected, or that a proper apparatus was not applied, she left the establishment with the limb in an almost useless state. On carefully examining the arm I observed, at its outer border and opposite the seat of fracture, an abrupt depression which evidently marked the angle formed by the broken ends of the bone; the inequalities of the fragments might also be felt. The hand was a little adducted, and the lower end of the ulna was very prominent. In both instances the injury resulted from a fall on the palm of the hand. When the first accident happened she was descending a staircase with two pails of water; in the second she was likewise going down stairs, but was not carrying anything. When she had got down a few steps of the third story she trod upon a rat, which bit her severely in the foot; she stumbled, and in seeking to save her head in the fall, the shock was received on the palm of the hand, and a fracture by contre-coup was the consequence: for the radius, being jammed between the humerus and the hand (the latter being fixed against the ground), was forcibly bent and so fractured near to its lower extremity. Considerable pain was experienced at the time of the occurrence of the accident; and the movements of supination and pronation were impracticable. On her admission the appearance of the limb alone sufficed to indicate the nature of the accident: a suitable apparatus was applied, and the case did well.

As I have not hesitated, in the course of the foregoing remarks, to express my own conviction respecting the improbability of the occurrence of a dislocation forwards at the wrist, it will be as well to analyse a case which Professor Cruveilhier has given; the only one of the sort which has been recently published with details.[1]

Case III. *Fracture of the radius; dislocation of the ulna backwards, taken for dislocation of the wrist forwards.*—The subject of this pathological condition was an adult female, respecting whom no history could be obtained. The fore-arm seemed shorter than natural; the lower extremities of the radius and ulna formed a considerable prominence beneath the skin, that of the radius, however, being less marked and not descending so low as that of the ulna. The upper extremity of the carpus was on a plane superior and anterior to that of the lower extremity of the bones of the fore-arm. The hand formed a right angle with the fore-arm, and was also inclined towards its radial side; and this inclination could be extended so as to bring their outer borders in contact. Extension was impracticable, but flexion could be carried much beyond a right angle.

---

[1] Anatomie Pathologique: Maladies des Articulations, p. 3.

On dissection, M. Cruveilhier found that all the muscles of the arm were atrophied; but this condition principally affected the muscles acting on the wrist-joint and radio-ulnar articulations, viz. the radial and ulnar flexors and extensors, and the pronators and supinators. The tendons of the radial and common extensors were lodged in a deep groove which existed at the posterior surface of the lower extremity of the radius; to this osseous excavation they were firmly adherent. The extensor carpi ulnaris was reflected at a right angle from the ulna to be inserted into the fifth metacarpal bone: the flexor carpi ulnaris was shrunken, and terminated as usual in the pisiform bone.

The carpus presented a singular deformity. The upper row of bones, reduced to a rudimentary condition, had lost their form and their volume, being, according to the diagram, diminished to less than half of their normal size: the pisiform bone alone remained unchanged. The corresponding surfaces of the second row were likewise altered: there only existed trifling rudiments of the os magnum and unciform bone; and in like manner the upper half of the trapezium and trapezoid, which should articulate with the scaphoid, was contracted. The ulna, which was very little changed in form, was prolonged five or six lines below the extremity of the radius: but a little above its inferior extremity, at a height corresponding to the lower end of the radius, it presented a deep excavation to receive an articular apophysis of the latter bone. It was united to the cuneiform bone by means of an extremely long ligament, which permitted of very considerable abduction of the hand. The radius was shortened and deformed; and the latter defect was principally observable at its lower extremity, which was enlarged and presented an appearance as if it had been crushed; it was also deeply grooved posteriorly for the united extensor tendons. There was a sort of transposition of the articular facette of the radius, which occupied the outer side of this extremity, whilst a prominent apophysis on the inner side articulated with the ulna. Lastly, the shaft of the radius was more voluminous than in its natural state, and the lines and elevations marking the insertion of muscles were unusually prominent: its upper extremity, instead of being excavated to receive the smaller head of the humerus, was convex, and its circumference appeared as if battered.

This case, which is given by M. Cruveilhier as an instance of dislocation backwards of the fore-arm on the hand, or of the wrist forwards, furnishes us with several important points for consideration: and first of all, in attentively examining the diagram, it is easily perceived that the antero-posterior diameter of the lower extremity of the fore-arm is very considerable. The articular surface appears to be evidently divided into two by a very deep chasm: the external portion is continuous with the shaft of the bone, and presents at its carpal extremity a conical projection which might very well pass for the styloid process; but externally and above is another and very regular conical projection, which is without its analogue in the natural bone. The other portion of the radius, which is much larger and broader, is not continuous with the body of the bone, but is supported by an oblong apophysis, rounded and separated from the shaft of the bone by a sort of constriction or neck. On the hypothesis that there had been fracture these two prominences admit of an easy explanation: the outer and upper projection is the styloid process; and the inferior represents the spine which separates posteriorly the tendinous canals of the radius.

It is moreover impossible to account for many of the other appearances on the supposition of dislocation having existed; thus, for example, in all dislocations, the displacement of a bone on one side of an articulation, always involves the inclination in an opposite direction of the lever which it represents;

whereas here the hand is in front. But to continue; why is the articular surface found upon an apophysis above the joint? Why is the radius so much curtailed of its length, whilst the ulna, which was at least luxated with it, and retained even less mobility, is half an inch longer below? On the supposition that there had been fracture or separation of the epiphysis, there is no difficulty in explaining and linking together all these phenomena. It is probable that the accident occurred in infancy, and thence the atrophy of the carpal bones. It is further likely that the fracture was the consequence of a fall on the back of the hand, in which case the violence of the shock would have thrown the epiphysis of the radius forwards together with the hand. In this way one may conceive that the extensor muscles would have been but little stretched; for if the fragments were separated in respect of their thickness, they were approximated in point of length. On the contrary, if there had been dislocation, the amount of tension would have corresponded to the breadth of the articular surface of the radius, which would have been very great. Again, the separation of the epiphysis accounts for the unusual apophysis which supports the new articulation; and the dislocated ulna is, as it should be, longer than the broken radius. It may be further observed that atrophy of the bones would follow long disuse of the limb consequent on dislocation of the radio-carpal articulation, and motion would become impracticable; whereas, in the present instance the joint could be flexed. We may therefore conclude that the case in question is one of dislocation of the ulna backwards, with fracture of the radius, and displacement of the inferior fragment forwards; a very remarkable case without doubt, but at the same time one which does not touch the disputed question of dislocations of the wrist.[1]

Having now clearly established the fact that the lower part of the radius may be fractured, it is time to direct attention to the signs by which it may be recognized. At the moment that an individual falls on the palm of the hand, he is usually conscious of a snapping sensation near the wrist; acute pain is also experienced; and in the course of a short time the lower part of the fore-arm, the wrist and hand become swollen.

---

[1] [There are some points about this explanation of the author which are a little obscure, for want of the illustrative diagram or preparation.—Tr.]

If carefully examined the head of the ulna is observed to be more or less prominent: and when the fracture exists at a quarter or half of an inch, or even more, from the radio-carpal articulation, the superior fragment or fragments are carried forwards; whilst the wrist and inferior fragment are directed backwards, and present a concavity in front: these are the prominences which lead to the erroneous impression that there is dislocation. But to this first displacement there is speedily added a second: the wrist is inclined towards the inner side of the fore-arm; the interosseous space is diminished or even obliterated, and, as a necessary consequence, the power of rotating the radius on the ulna is irretrievably lost, if the nature of the lesion is misunderstood. In all instances where there is fracture of the lower extremity of the radius, a depression, more or less marked, is observed on the radial side, at the point where the solution of continuity is supposed to exist. On measuring the transverse diameter of the anterior surface of the fore-arm on the sound side, it is found to exceed that of the affected limb; whereas the antero-posterior diameter of the latter is somewhat augmented. Crepitus is readily distinguished. In practising extension on the hand, whilst the fore-arm or upper-arm are counter-extended, the deformity speedily disappears, but reappears as soon as extension is abandoned. Add to the above the displacement of the styloid process of the radius, the marked swelling of the anterior part of the fore-arm, the flexion of the fingers, and the difficulty of moving the hand, and the signs are complete. I do not mean to say that these evidences of fracture are always found associated; in a considerable number of cases many of them are not very readily distinguished.

The diagnosis of fractures of the lower extremity of the radius merits serious attention, on account of their having been, and still being, so often mistaken for dislocations of the carpus backwards. It is, nevertheless, very important to avoid falling into this error, as the treatment of fracture differs essentially from that of dislocation; and on the application of appropriate measures depends the restoration or loss of certain movements of the fore-arm. I have remarked that many able practitioners have mistaken fracture for dislocation; the following is a case in point.

Many years since, a mason who had fallen from a great elevation was brought to the Hôtel-Dieu. He had several severe injuries, and amongst them a fracture of the skull: there was also a deformity of one of the wrists. Several surgeons were of opinion that this depended on dislocation of the carpus backwards: I, however, stated my impression that the lesion was a fracture at the lowest part of the fore-arm; in which opinion I stood alone. The patient died from the effects of the injury to his head; and an examination of the body proved the correctness of my diagnosis, as there was fracture, and the joint remained intact.

A similar case occurred more recently in another hospital at Paris. M. Marjolin pronounced the injury in this instance to be a dislocation, and dissection showed that there was only fracture.

Case IV. *Fracture of the lower extremity of the radius badly united; anatomical examination of the parts.*—In the course of the year 1820, M. Payen was struck, in examining the body of an old man, with the peculiar appearance of the right radius. Externally this bone seemed very much abducted; and towards the lower part of the outer border, about an inch above its extremity, a well-marked and abrupt depression was noticed and felt. On the inner side there existed a considerable prominence, nearly an inch in extent, formed by the ulna which was very much forced inwards: the depression marking the position of the wrist was correspondingly deep. The hand had sustained no displacement either forwards or backwards: it simply constituted with the fore-arm a continuous plane, and the motions of flexion and extension were lost.

When the bones were dissected with the ligaments connecting them, M. Payen found an old fracture of the radius about an inch and a half from its lower extremity. The level of this fracture formed the centre of a bow which the entire bone would represent, and the string of which would consist of the radial extensors. The inferior extremity was much broader and thicker than naturally; its breadth being two inches and its thickness about one inch. The anterior part of this extremity was even and regular; but the posterior was very irregular, and presented a deep longitudinal groove in its centre, bounded by abrupt projections, and unevenly subdivided. The radius, in its entire length, was shortened by about nine or ten lines.

All these changes resulted from a comminuted fracture; for there were traces of three fragments, a superior which consisted of the main portion of the shaft of the bone, an inferior formed by the lower extremity of the bone, and an intermediate portion which did not comprise the whole circumference of the radius. The inferior extremity of the upper fragment had descended on the inner side of the lower, thus approaching the ulna and occupying the interosseous space, and being at the same time directed slightly forwards. The lower fragment was displaced in a contrary direction, being thrown outwards. The middle fragment was lodged at the back and inner part of the lower extremity of the radius, opposite to the lower end of the upper fragment.

The radial flexor and extensors, and the long extensor of the thumb (the contraction of which had not been counteracted by a suitable apparatus), continuing to operate on their insertions, had caused the lower extremity of the upper fragment to descend as low as the upper row of the carpal bones; and the work of consolidation progressing under these circumstances, all these parts had become united in this vicious manner, so as to render them continuous, and to leave no interval between them. It was also apparent that the anterior part of this lower portion of the bone was formed, in great measure, by the inferior extremity of the upper fragment; and that the two posterior projections were severally formed by the middle and lower fragments, the latter of which was twisted outwards: the interosseous space was singularly contracted near the wrist.

The ulna was parallel to the radius; but instead of being shorter at its carpal extremity, the former extended an inch and a half beyond the latter. The whole length of the ulna appeared to be twisted, so that its anterior surface was directed outwards, the consequence of which was that the lower part of the fore-arm presented a deep furrow, whilst the posterior was nearly flat.

The outer part of the lower extremity of the radius had two fibrous bands firmly attached to it, one of which appeared to be the extensor of the metacarpal bone of the thumb; the other was the external lateral ligament of the wrist-joint. The individuality of the carpal bones was entirely lost; some inequalities alone marked the original lines of separation between them: the upper row was likewise cemented to the inferior extremity of the radius, and the lower row to the corresponding metacarpal bones. The lower extremity of the ulna and the carpal extremity of the first metacarpal bone were united by ligaments in the usual way, severally to the radius, the cuneiform and trapezium bones. The whole circumference of the lower extremity of the radius, and both surfaces of the carpus were invested by a fibrous layer, which was thicker and tougher than the periosteum in its natural state, and adhered very firmly to the bones.

Case V. *Old fracture of the radius viciously united; phlegmonous erysipelas, and death.*—Jeanne Henry, aged 63, was admitted into the Hôtel-Dieu in 1821, in a dying state. This woman had the left elbow in a state of phlegmonous inflammation, with destruction of the skin to a considerable extent: there was also a very large slough on her left hip; and the knee of the same side was likewise in a state similar to that of the elbow. The constitutional symptoms were correspondingly severe, accompanied by great prostration; and her ideas were so confused that she could give no distinct account of the origin of her attack: she died on the following day at noon.

In the course of examining the affected elbow, I discovered an old fracture of the radius, resembling a dislocation of the wrist. The carpus was prominent in front; and posteriorly, immediately below the inferior extremity of the radius, there was a remarkable depression. As already observed, the condition of the patient did not permit us to obtain any information respecting this injury. When the parts were dissected, this fracture was found to involve the thick part of the bone, which it traversed obliquely from before backwards; and the lower fragment, which was not more than half an inch in extent, projected considerably backwards. There was reunion between this and the upper fragment, the latter constituting a less marked prominence on the front of the bone. The displacement which the lower fragment had undergone was very apparent, and had been produced by the action of the muscles extending the hand and fingers: the tendons of these muscles, which pass over the posterior surface of the radius at its lower extremity, were much further removed from this bone, immediately below the lower fragment, than in their natural state. Neither the carpal ligaments nor periosteum of the inferior extremity of the radius presented any sensible alteration of texture; but the posterior half of the cartilage belonging to the latter was destroyed, and replaced by false membrane of an areolar character.[1]

Amongst the affections which may be mistaken for dislocation, there is one which it will be right to notice, and of which I have seen several examples. The abnormal peculiarity of the wrist-joint to which I allude has been very much overlooked by practitioners, although striking examples of it are met with in certain workmen, and especially in those who are employed in working the press in ordinary printing, or printing on calico, by which the hands are abruptly, frequently, and violently dragged. Under the influence of these continual efforts, it is by no means rare to see the ligaments of the wrist become relaxed and stretched, to such a degree as to permit the movements between the bones to be much more extended than in their natural condition. The carpus being then no longer firmly fixed to the fore-arm, yields to the action of the flexor muscles, and assumes a position in front of the inferior extremities of the radius and ulna: in short, all the signs of dislocation of the carpus forwards are apparent, but unaccompanied by pain or inflammation. A more or less marked deformity and weakness of the parts are the only annoyances arising from this displacement: the patient himself can usually restore the parts to their normal relation by drawing the hand from the fore-arm; but the luxation is reproduced at will, or even during repose by the simple preponderance of power of the flexor over the extensor muscles. Individuals thus affected scarcely ever seek medical assistance; for the lesion entails so little inconvenience that it does not oblige them to give up their occupations.

When fracture of the lower extremity of the radius has been overlooked, mistaken for dislocation, or left entirely to itself, the resulting changes greatly curtail the use of the limb: the interosseous space is obliterated; the fore-arm, instead of presenting at this part a flattened surface anteriorly and posteriorly, assumes a cylindroid form, and the motions of pronation and supination are entirely lost. Such was the case with an individual who came, in 1829, to the Hôtel-Dieu. This man had broken the lower end of the radius by falling on the wrist; and the fracture was immediately above the radio-carpal articulation: he was not admitted into the hospital until six weeks after the accident. The lower part of the fore-arm was swollen, deformed, and quite cylindroidal; and the power of rotating the radius on the ulna was quite lost: of course it was too late to attempt anything for his relief.

---

[1] [The details of the general autopsy have been omitted, as not in any way bearing on the subject under consideration.—Tr.]

Case VI. *Fracture of the lower extremity of the radius viciously united; movements consequently impaired.*—Marie Ropp, aged 76, was admitted into the Hôtel-Dieu, there to remain until she could be removed to an asylum for incurable patients. She was the subject of numerous infirmities, amongst which were a weak intellect and chronic pulmonary catarrh. This woman stated that she had been under treatment several times at the Hospital of St. Louis for fractured limbs: in fact, the right arm alone remained unmutilated and capable of perfectly performing its functions.

The left radius had been fractured about an inch from its carpal extremity, and union had taken place, when the ends of the fracture were as much displaced as they possibly could be. At the seat of the fracture a deep depression existed, which caused the radial border of the fore-arm to present a long curvature, the convexity of which was directed towards the interosseous space. The displacement of the lower fragment entailed another consequence, which was great abduction of the hand; and by the separation of the latter from the ulna, this bone was rendered very prominent at its inferior extremity. Below the styloid process of the ulna there was a deep depression, owing to the abduction of the hand. Lastly, the fingers were inclined inwards, so that the lower part of the fore-arm and hand together had the form of the letter S.

The above cases will serve to justify the observation which I have already made, that the surgeon should proceed to reduce these fractures as soon as possible, and that a misapprehension of the nature of the injury is always attended by impaired use and deformity of the fore-arm. For the purpose of accomplishing the proper adjustment of this form of fracture, the limb should be separated from the trunk, and the back of the hand turned upwards, the fore-arm being semiflexed on the upper-arm. The assistant, whose business it is to make counter-extension, grasps the inferior part of the upper-arm, whilst another assistant makes gradual extension on the hand, directing it at the same time towards the ulnar side of the fore-arm. The surgeon placing himself on the outer side of the limb, presses with both hands the fleshy part of the fore-arm, both before and behind, into the interosseous space; and then by suitable manipulation, brings the fractured ends into apposition. The reduction is effected without difficulty, but it is not always so easy to keep the ends of the bone in proper relation.

When this first part of the operation is achieved, I apply the usual apparatus for fractures of the fore-arm, that is to say, a bandage for the hand, two graduated compresses on the anterior surface of the fore-arm, and two on the posterior; and over these two broad splints: the whole is to be made fast by several turns of the same bandage with which the hand has been rolled; continuing it as high as the elbow, and thus covering the splints without exercising any lateral compression on the radius or ulna. This method of applying the apparatus combines every advantage, and is infinitely preferable to that which consists in rolling the arm first of all, as by this course the fragments are compressed, and the interosscous space is encroached upon; whereas the object is to keep the bones as far apart as possible.[1]

There is a circumstance connected with fractures of the lower extremity of the radius, which is of considerable importance though unnoticed by authors, viz. the tendency of the hand towards the radial side of the fore-arm, by which the lower fragment is forced inwards. I have elsewhere noticed[1] the remarkable fact that, in fracture of the lower extremity of the radius, the same re-entrant angle is found on the fractured side, and the same salient angle on the ulnar side, as in cases of broken fibula; and as in the latter, so in the former instance, the sign in question is one of the most decisive in determining the existence of fracture. If this tendency be not counteracted, union will take place whilst the bones are in this position; and deformity together with impaired power of rotating the fore-arm are the consequences. In some instances the displacement in question is so great, and the prominence of the ulna so considerable, that this bone appears as if curved; and many practitioners have been thus misled into the belief that there was dislocation of its carpal extremity.

---

[1] [The interosseous membrane constitutes a safeguard against the too great separation of the bones. The desired effect is further ensured by the employment of convex splints, adapted with their convexity directed towards the centre of the arm.—TR.]

For at least twenty years I have been in the habit of pointing out this marked tendency of the hand to become abducted in fractures of the radius; but, until lately, I have not been able satisfactorily to combat the difficulty. Recently, however, I have devised the addition of a *cubital* splint to the ordinary apparatus: it consists of a steel plate, covered with leather, about fifteen inches long, an inch and a quarter wide, and one line in thickness. It is divided into two parts, one straight, and the other semicircular and corresponding at the commencement of its curve to the wrist: the concavity of the latter division has five studs, placed at equal distances from each other. The ordinary apparatus for fractures of the fore-arm being applied, the straight part of this splint is to be fastened against the inner margin of the ulna with a roller: a pad is then placed between the inner side of the wrist and the lower end of this splint, so as to separate them: the hand is afterwards drawn towards the convexity of the curved portion of the splint, and the tapes by which they are kept in contact are passed round the second metacarpal bone and made fast to the studs in its concavity. It is not difficult to understand the *modus operandi* of this apparatus: the pad serves at once to correct the projection and (apparent) curvature of the ulna, and to act more efficiently on the fracture; whilst the abduction of the hand, through the agency of the external lateral ligaments of the wrist, tends to preserve the accurate adjustment of the fragments. I have, by the above simple method, succeeded to my entire satisfaction in curing these troublesome fractures, without any deformity or sacrifice of the rotatory motions of the fore-arm.

---

[1] [See the chapter on Fracture of the Fibula. The preceding description is somewhat ambiguous from the expression "en dedans" being applied to the radial side, and "en dehors" to the ulnar. This has been corrected in the translation: the author must have considered the hand prone in thus expressing himself.—Tr.]

CASE VII. *Fracture of the lower extremity of the left radius.*—Constance Varin, aged 58, a married woman, of good constitution, was suddenly seized with giddiness whilst going down stairs, and fell. She quickly recovered her consciousness, and went on her way, although suffering very severe pain in the lower part of her left fore-arm. She was brought to the Hôtel-Dieu on the same day that the accident occurred (in December 1819), but was unable to say on what part of the limb she had fallen; it was not, however, difficult to solve the question, as the palm of the hand was soiled by the dirt with which the steps of the staircase were covered.

The left wrist was very prominent behind, but hollowed in front; the ulna of the same side presented a convexity at its lower and inner part, conveying the impression of its being curved at this point; at the lower part of the radial side of the fore-arm was a marked depression: the hand was drawn to the radial side, and there was manifest crepitus, together with severe pain and loss of the power of rotating the arm. By fixing the fore-arm and drawing the hand from it, the parts could be brought into their normal position and relations; but the deformity reappeared as soon as the extension was relaxed. The existence of fracture of the base of the radius being thus established, the usual apparatus for fractured fore-arm was first applied, and subsequently the cubital splint as described above; the limb was afterwards placed, semiflexed, on a pillow.

This apparatus several times became loosened, and it was necessary to tighten the confining bandage and tapes. On the thirty-eighth day after its application it was removed, and the limb had then recovered its natural form: the hand, for the first few days, was inclined towards the ulnar side of the fore-arm; the patient also complained of some pain in the radio-carpal articulation, and the motions of pronation and supination were cramped and painful: but all these gradually yielded to time and exercise, and she left the hospital perfectly cured in less than seven weeks from the time of her admission. In this case not the slightest deformity remained.

Case VIII. *Fracture of the lower extremity of the radius; dislocation backwards of the fore-arm on the humerus; fracture of the neck of the femur on the right side. Death some hours after the accident.*—François Richehomme, aged 29, a tiler of athletic make, was on the roof of a house four stories high, whence he fell on to the pavement: this occurred in July 1815. He was immediately brought to the Hôtel-Dieu; and though still retaining his consciousness on admission, he died in the course of a few hours of the severe injuries he had received. On examination of the body the following lesions were discovered; they were exclusively confined to the right side, which no doubt had sustained the entire shock of the fall.

There was fracture of the radius an inch from its carpal extremity, recognizable by marked abduction of the hand, accompanied by depression at the seat of fracture, and prominence of the whole length of the ulna, especially at its styloid process. The carpus also projected behind; and this appearance resembled a dislocation of the hand backwards, but was due to the action of the extensors of the thumb and fingers which had produced the displacement in question. The projection of the lower fragment could also be felt, as well as that of the upper fragment; which latter being directed forwards, a good deal puzzled those who thought there was dislocation of the wrist: there was also crepitus and abnormal mobility. When the skin was raised and the muscles were exposed, those on the radial side were found contracted and hard: this condition depended on the loss of leverage or resistance which the radius presents in its integral state to the muscles which extend along it: the same circumstance is observed in other fractures, of the neck of the femur, for instance, in which case the abductors are the visible seat of contraction. It is to the agency of the above muscles of the arm that the displacement of the fragments and abduction of the hand are due. The fracture itself was irregular ; [illegible] small spicula of bone which were [illegible] there was no displacement of the fractured ends as regards the axis of the bone, because there is no interosseous space at that part of the arm (close to the wrist); but, as already noticed, the upper fragment was directed forwards and downwards, and the lower upwards and backwards.

The fore-arm was also found dislocated from the articular base of the humerus; the skin and muscles were torn on the inner side of the joint by the inner condyle which projected through them, and much blood had been lost from this wound after the accident: the fore-arm was shortened, slightly flexed, and could not be extended. The olecranon, which was out of the cavity that receives it, formed a considerable prominence behind; and the concave surface of the head of the displaced radius also projected beneath the skin. When the skin was raised, the biceps and brachialis anticus were found lengthened and pushed forwards by the lower extremity of the humerus: the lateral ligaments and surrounding muscular fibres were lacerated, and a great deal of blood was extravasated in this region. To explain how this lesion coexisted with fracture of the radius on the same side, we must suppose that when this bone gave way, the ulna in its turn received the shock produced by the fall; the weight of the body on one hand, and the resistance of the ground on the other, being sufficient to drive the humerus downwards and the ulna upwards, aided as these forces must have been by the contraction of the muscles.

There was likewise a fracture of the neck of the femur, indicated by the presence of the usual symptoms. When the surrounding soft parts were removed, the fracture was exposed: it extended from the lower part of the neck of the bone into the body, so that the upper fragment included the small trochanter: the articular capsule was uninjured. This lesion was probably occasioned by the shock of the fall being received on the anterior part of the great trochanter, which, together with the shaft of the bone, was torn, as it were, from the neck and smaller trochanter, the rupture commencing in front. The liver and kidney were also ruptured, and there was much blood extravasated into the abdomen.

CASE IX. *Fracture of the lower extremity of the radius undetected for twelve days; subsequent reduction and cure.*—

Armand Amegard, aged 30, a carrier, was amusing himself in the Champs-Elysées in July 1831, by a ride on one of the wooden horses, when he fell on the palm of his left hand. He immediately experienced an acute pain at the lower part of the fore-arm, which was speedily followed by considerable swelling. He went to a doctor on the same evening, who ordered him to leech and foment the part. This treatment was repeated, but without any alleviation of the symptoms: the patient also complained of great difficulty and suffering in rotating the arm. After twelve days had elapsed, he felt some relief, but not regaining the use of the arm, he determined to apply at the Hôtel-Dieu. The affected fore-arm was then nearly of its natural size, but the hand seemed to be much more drawn towards the radial side than usual. When the outer border of the radius was gently pressed, a slight depression could be felt about an inch from the carpal articulation: and if the shaft of the bone was fixed, and the hand and base of the radius were rotated, an obvious movement could be distinguished, as of one smooth body gliding over another, but no crepitus. On the following day the fracture was reduced, by placing the fore-arm at a right angle with the upper-arm, and making extension by the hand whilst the arm was fixed: I pressed at the same time on the ulnar side of the fore-arm, so as to bring the fragments into their natural relation. The usual apparatus, including the cubital splint as already described) were then applied. In consequence of having business to attend to, this patient could not remain in the hospital longer than eighteen days, but he promised to keep on the apparatus for a fortnight afterwards, at the expiration of which time it was removed, and union was complete, without any deformity. He has since entirely recovered the use and original power of the fore-arm.

The succeeding two cases are not only interesting as fractures of the radius, but they are further deserving of attentive consideration on account of the serious complications which accompanied them, and which were the consequence of forgetting an important precept. More than once, indeed, it has
that the surgeons have been so intent on
in their proper position, that the exter
has actually caused destruction

advice which I have very frequently given, and which I cannot too often repeat is, to avoid tightening too much the apparatus for fractures, during the first few days of its being worn; for the swelling which supervenes is always accompanied by considerable pain, and may be followed by gangrene. It cannot, therefore, be too urgently impressed on young practitioners, to pay attention to the complaints which patients make; and to visit them twice daily, and relax the bandages and straps as need may be, in order to obviate the frightful consequences which may spring from not heeding this necessary precaution: by carefully attending to this point I have been saved the painful alternative of ever having to sacrifice a limb for complications which its neglect may entail.

Case X. *Fracture of the radius; apparatus applied too tightly, and consequent gangrene; amputation, and cure.*—Antoine Rilard, aged 44, fractured his right radius whilst going down into a cellar, in February 1828, and went at once to the Hospital of La Charité. When the fracture was reduced, (it was near the base of the bone), an apparatus was applied, but fastened too tightly: and, notwithstanding the great swelling, and the acute pain which the patient endured, it was not removed until the fourth day, when the hand was cold and œdematous, and the fore-arm red, painful, and covered with vesications. Leeches, poultices and fomentations were applied, and followed by some alleviation of the local symptoms, though there was much constitutional disturbance. At the close of a fortnight from the accident, the palmar surface of the fore-arm presented a point where fluctuation was supposed to exist; but when a bistoury was plunged into it no matter followed. Portions of the flexor muscles subsequently sloughed, and the skin subsequently mortified. The only resource was amputation, which was performed above the elbow six weeks after his admission; and he afterwards recovered without the occurrence of any further untoward symptom.

Case XI. *Fracture of the lower extremity of the radius; gangrene of the fore-arm, produced by applying an apparatus too tightly; amputation and death.*—R., aged 36, a bricklayer's labourer, was at work boring an artesian well in 1832, when he was struck by a part of the machinery on the right fore-arm: he was instantly knocked down, and thrown violently on his right thigh. A surgeon, who was sent for, detected a fracture of the radius, and applied the usual apparatus, consisting of pads and splints, confined by a roller extending from the extremities of the fingers to the elbow, which compressed the arm so tightly as to give rise to very great suffering. The fingers, hand, and fore-arm were numbed almost to insensibility, and yet the surgeon in attendance did not think proper to loosen the apparatus. Such was the condition of the patient until he came to the Hôtel-Dieu four days after the accident: the fingers were then black, cold, and insensible, and when I removed the splints I found the hand likewise black, especially on its palmar surface. The lower part of the fore-arm was a shade less livid, but equally cold and insensible; and several vesicles filled with pink-coloured serum were apparent on both its surfaces, where the splints had pressed: the upper part of the fore-arm was inflamed, swollen, and very painful. He was bled, and leeches were applied to the inflamed part of the arm: camphorated spirit was applied to the fingers.

On the following day heat was restored as low as the wrist, but the hand remained for the most part livid and cold, and the radial artery did not pulsate. Seventy leeches were applied to the fore-arm, and the local application was continued. On the second day after admission warmth and sensibility were recovered on the dorsal surface of the fingers, but their palmar surface was unchanged: and the heat and tension of the fore-arm called for the application of thirty more leeches: the patient was allowed some broth. On the fourth day the hand had further recovered itself so far as to encourage some hope of its being saved; but this was again blighted on the sixth day by the entire loss of heat and sensibility in the part, and increased pain and swelling in the fore-arm, to which the gangrene subsequently extended. On the twelfth day amputation was performed at the elbow-joint; but the patient did not survive the operation more than ten days, the immediate cause of death being acute pleurisy. There was a considerable quantity of purulent serosity poured out on the right side of the chest;

and abscesses were found in the lungs and liver. On examining the arm, there was found to be a simple fracture of the radius about its centre.

The above case presents a painful illustration of the neglect to which I have alluded. In nearly every instance the swelling of the limb requires that careful attention should be paid to the bandage or straps by which the apparatus is confined. Similar accidents are likely to result from the employment of an immovable apparatus, of which an example occurred in the practice of M. Thiéry, one of my pupils. He was summoned to visit a young girl, on whom such an apparatus had been applied for supposed fracture of the radius. After suffering excruciating torment, the fore-arm mortified, and amputation was the only resource: on examining the limb no trace of fracture could be discovered! Had a simple apparatus been here employed, and properly watched, this patient's limb would not have been sacrificed.

I shall conclude this chapter with the following summary of the conclusions to be drawn from the foregoing considerations, and from the details of the cases which have been given.

1. Without positively denying the possibility of dislocation backwards at the radio-carpal articulation, although I have never met with a case, it must, at least, be admitted that the accident is an extremely rare one; and that perhaps it has never existed as the consequence of a fall on the anterior part of the wrist.

2. The cases which have been described by authors as dislocation of the wrist backwards, were probably only fractures of the radius, situated at a distance varying from a quarter of an inch to an inch from its lower extremity; or a similar injury involving the ulna likewise.

3. The practice of rolling the arm before the splints are applied, whether internal or external to the pads and compresses, is eminently mischievous; and, instead of fulfilling, directly counteracts the indication which it is most important to keep in view, in the treatment of fractures of the fore-arm.

4. The tendency exhibited by the radius to become displaced towards the ulna, which is so commonly met with, and

from which the abduction of the hand results, calls for the employment of a special counter-agent: the object in question is best attained by the employment of the ulnar splint (described above).

5. Where no such tendency to displacement exists, the ordinary apparatus for fractures of the fore-arm is by itself sufficient to preserve the proper adjustment of the fractured ends, during the subsequent work of reparation.

[*Note.* The reader may be reminded that by the expressions "backwards" and "forwards," employed in reference to dislocations of the wrist, the altered position of the carpus in relation to the radius is intended.—Tr.]

CHAPTER VIII.

ON DISLOCATIONS OF THE LOWER EXTREMITY OF THE ULNA.

Dislocations of the ulna on the radius, whether backwards or forwards, are of extremely rare occurrence. The first recorded case was observed by Desault at the Hôtel-Dieu, in the body of an individual brought in for dissection. Since 1773 other cases have been collected: but in the course of my long practice it has occurred to me to witness only two instances of this form of injury, which I will narrate.

Case I. *Dislocation of the ulna forwards.*—M. Blot, aged 32, of an athletic frame, was commanding a patrol at midnight on the high-road, when his horse, being frightened by the approach of a diligence, reared, and fell with his rider under him. M. Blot received no hurt except in his right wrist, which was crushed between the horse's head and the ground; and the pain at the time was so great, that he thought he must have broken his arm. The surgeons who were first called in detected the nature of the injury, and attempted its reduction, but without success: the patient was therefore sent to Paris, and was seen by me about thirty-four hours after the occurrence of the accident, when the following symptoms presented themselves.

There was considerable swelling of the lower part of the fore-arm, particularly around the wrist: the hand was in an intermediate position between pronation and supination; and the inferior part of the fore-arm was deformed, being more rounded than natural, and consequently contracted in its greatest diameter: but, as the radius was neither broken nor displaced, the carpus presented no abnormal prominence either before or behind. On carrying the finger along the ulna from the olecranon to the styloid process, it was evident that this bone had suffered no solution of continuity: the natural relation of its lower extremity to that of the radius was, however, lost; for, instead of being attached to the latter, it was found to be occupying a position on the fore part and middle of the wrist. This altered relation was apparent to the sight, and confirmed by manual examination: and the shaft of the ulna could be distinctly traced in an oblique direction forwards and outwards, crossing anterior to the radius at its lower part. Further, some indistinct abnormal mobility was detected, or thought to be felt, about the lower extremity of the radius, and the wrist was a good deal bruised; but there was no crepitus: the rotatory movements of the fore-arm were completely lost.

To reduce this dislocation the patient was seated in a convenient position, and a sheet was passed through the right axilla and fixed to a ring in the wall; another cloth was also applied in folds around the elbow, and intrusted to assistants, who were directed to keep the fore-arm at a right angle with the upper arm: lastly a napkin was fastened around the wrist, by which other assistants were directed to make extension. The hand was then forcibly drawn to the radial side, whilst I made pressure with my two thumbs on the luxated extremity of the ulna in a direction inwards and backwards; and shortly afterwards the reduction was effected with an audible snap. Deformity at once disappeared, and the natural movements of the arm were restored. As a precautionary measure the ordinary splints employed for fracture of the fore-arm were applied for a time, and the patient soon left the hospital to return home.

Case II. *Dislocation of the ulna forwards.*—A builder, aged 45, in supporting with his right hand a scaffolding which threatened to fall, felt at the moment a severe pain at the lower part of the fore-arm. He immediately came to consult me at the Hôtel-Dieu, and the arm and wrist presented all the symptoms which have just been detailed as existing in the former case. The same means were resorted to for the reduction of the dislocation, and with similar success, all appearance of deformity at once ceasing, and the pain and swelling subsiding shortly afterwards.

These are the only two cases, during the twenty-four years that I have been surgeon to the Hôtel-Dieu, which I remember to have witnessed. Sir A. Cooper has likewise met with two cases of dislocation of the inferior extremity of the ulna, but they were in a direction backwards, which is less rare, though more serious on account of the accompanying laceration of soft parts, than the forward luxation: hence the proposition of the English surgeon to amputate in these cases. In one case at the Hôtel-Dieu, M. Breschet excised the dislocated end of the bone.[1]

How far more useful would it be to science, if authors would be at the trouble of observing and narrating what they themselves have seen, rather than of copying without examination the descriptions of their predecessors: we should then probably obtain more well-authenticated cases of rare accidents. In the case above described there was no laceration of the integument; and indeed in the forward dislocation of the carpal extremity of the ulna this complication must be rare, as the resistance offered by the superjacent structures is great. But such is not the case in the luxation backwards, where the bone is prominent, thinly covered and badly protected; hence the liability of the skin in this position to ulcerate in chronic inflammation of the joint, such as follows certain gun-shot wounds: the sharp border of the styloid process of the ulna readily makes its way through the skin.

If asked what treatment I should adopt in a case of dislocation attended by laceration, my answer is that I would reduce it at once, and have recourse, if necessary, to active antiphlogistic measures, to meet (what is most to be feared) inflammation of the aponeurotic textures: I would not have recourse to excision unless absolutely driven to it; and amputation I regard as the very last resource, which nothing short of positive necessity can justify.

---

[1] [Probably the case narrated at page 127.—Tr.]

CHAPTER IX.

ON DISLOCATIONS OF THE THUMB AND FINGERS.

All authors who have written on the affections of bones concur in admitting that dislocation of the first phalanx of the thumb is often very difficult to reduce, and in some cases absolutely irreducible. These difficulties are evidently attributable to the character of the articulation; and in order thoroughly to appreciate this, it is necessary to examine carefully the surrounding muscles and ligaments, and especially to take into the account those which have their attachments close to the articulating extremities of the phalanges. It is evident, therefore, that we must not be satisfied with a simple knowledge of the relation of the articulating ends of bones to each other, although there can be no doubt that their mutual adaptation and harmony of contact is one essential cause of the ordinary integrity of joints; but it is also requisite to acquire a perfect acquaintance with the muscular apparatus in its healthy and abnormal conditions, for a proper comprehension of the mechanism of dislocations, and a due appreciation of the difficulties attending their reduction. Thus, every luxation is attended with more or less tension or relaxation of the muscles attached to the displaced bone; and in consequence of such altered relation to the centre of motion, abductors may be converted into adductors, flexors into extensors, &c. With these preliminary remarks I shall introduce to the reader some cases of dislocation of the thumb.

Case I. *Fall on the hands, accompanied by dislocation of the thumb and fracture of the fore-arm.*—A woman, 60 years of age, probably in a state of drunkenness at the time, reeled and fell, her two hands being extended instinctively in front of her, to preserve her body from the anticipated shock. The consequence was a fracture of the radius on the right side;

but on the left the thumb appeared to have sustained the effect of the concussion, for there was a dislocation of its first phalanx from the metacarpal bone. The thumb was in the position which some persons are able to make it assume by forcibly bending it: the prominence of the metacarpal bone was distinct on the palmar surface, and the base of the first phalanx on the dorsal surface of the hand. These dislocations, the reduction of which at first sight would appear so simple, often present insurmountable difficulties; sometimes gangrene has been known to follow the ineffectual attempts which have been made at reduction. In the present instance the first essay failed, although the patient had been previously blooded. On the following day she was again bled, and an anodyne draught was administered; and on the third day after the accident a second attempt was made, which was successful. A strong noose was firmly attached around the thumb, and extension made, with the precaution of retaining the thumb in the abnormal direction it had assumed, that is, nearly transversely across the palm: there was not much difficulty experienced this time.

It seems probable that the impediments encountered in these cases are in great measure referable to the altered relation of the lateral ligaments, which are naturally parallel to the axis of the bones implicated; and doubtless the spasm of the muscles has much influence in augmenting the difficulty. In addition to this, the shortness of the organ to be acted on and the proximity of the seat of luxation contribute to render the obstacles to reduction in some of these cases insurmountable. [In other words, the lever is short, and the moving power must be applied near to the fulcrum, and is thereby proportionately diminished: whilst the part to be moved is fettered by the abnormal position of the ligaments and antagonising agency of the muscles.]

Case II. *Fall on the palm of the hand; luxation backwards of the first phalanx of the thumb.*—A stout man, aged 28, fell on his hand, the principal amount of the shock being received on the palmar surface of the thumb. This part immediately became the seat of pain and severe spasm, and could be neither flexed nor extended. A surgeon who was called in made several attempts to reduce the dislocation, but they were fruitless: and the patient did not present himself at the Hôtel-Dieu until more than three weeks had elapsed after the occurrence of the accident: the symptoms were then as follows. Anteriorly the prominent head of the metacarpal bone could be distinctly felt, almost immediately under the skin; and on its back part the base of the first phalanx rested. They did not, however, form a nearly right angle together, as is generally the case; but the direction of the two bones was parallel, the displacement principally affecting the length of the thumb: and the fold of skin between the thumb and index-finger, instead of being single, was double with an intervening triangular space, the base of which corresponded to the root of the thumb. It is almost unnecessary to add that the latter was shortened, that the ungual phalanx was a little flexed, and that flexion and extension of the first phalanx were impracticable: but it may be interesting to notice that the latter phalanx could be readily moved from side to side, without producing the least pain: there was, at this time, no swelling in any part of the hand. Such was the state of things when the patient was taken into the operating theatre; but though every effort was made (as in the former case), and as much force as was admissible employed (several students aiding), still the essay to reduce the dislocation proved fruitless, and the patient was returned to bed, necessary precautions being taken to anticipate the inflammation which it was feared might follow.

Similar cases to the above have been recorded by most authors on the subject, who admit that luxations such as that narrated become irreducible, if any considerable time is allowed to elapse before an attempt is made to reduce them: and this difficulty I attribute to the causes already enumerated, and especially to the altered relation of the short lateral ligaments, provided they are not torn through at the time of the accident. If such obstacles to reduction exist at the expiration of a few weeks, *à fortiori* it cannot be expected that the difficulty will be overcome after an interval of some years: I should not, therefore, recommend any attempt to be made in the latter class of cases, of which the following may serve as an illustration.

Case III. *Fall on the thumb, followed by dislocation; of ten years' standing.*—A woman, 58 years old, was admitted into the Hôtel-Dieu for ulcers on the leg; and a deformity being observed in her right hand, it was carefully examined and proved to be a dislocation of the first phalanx of the thumb on to the metacarpal bone, which the patient said was the consequence of a fall on the thumb. The joint presented the following appearance: the first phalanx had passed in front of the metacarpal bone, and was forcibly turned back towards the dorsal aspect of the hand and inflexible; whereas, the ungual phalanx was flexed on the first, and equally resisted any effort to extend it. No attempt was made at reduction.

Case IV. *Dislocation forwards of the second phalanx of the thumb on the first, followed by white swelling.*—Joseph Valentin, aged 36, a coachman, of robust constitution and lymphatic temperament, had his thumb turned back by the wheel of a cart, the evening prior to his admission into the hospital. Its palmar surface was contused and lacerated, and the ungual phalanx was luxated on the second. There was no difficulty experienced in the reduction; the wound was dressed, and the thumb was wrapped in a poultice. Inflammation unfortunately was set up and could not be readily controlled; and when at last its active character was mitigated, it assumed a chronic form: the thumb remained tumid, though the skin recovered its natural pink appearance; but the joint became unnaturally movable, and the first phalanx ceased to be in contact with the second; the deviation being in a lateral direction. This patient remained for some time in the hospital, but his progress towards recovery was very slow. We thus see, as we proceed with the history of these injuries to the thumb, that the accidental circumstances accompanying them assume a character of more serious importance: the following case will still further develope this fact.

Case V. *Dislocation of the second phalanx of the thumb; tetanus, death.*—In July 1825, Sylvain Cahet, aged 19, was received into the Hôtel-Dieu, having fallen with violence on the pavement whilst running. The extremity of the right thumb was, by this accident, forcibly bent backwards, and the ungual phalanx was thus luxated forwards on the palmar surface of the first; the neighbouring soft parts being at the same time lacerated. The reduction was easily effected, and the patient did not suffer much: but in the course of a short time inflammation of the injured part supervened. It was not until ten days after the accident, and when the above symptoms had made their appearance, that he came to the hospital: he then also complained of some difficulty in opening his mouth. On the following day these symptoms were aggravated, and first, trismus, afterwards tetanus, were fully established. [The symptoms were of the most distressing character, such as are usually witnessed in the worst forms of this fearful disease: the treatment consisted in the exhibition of morphia, and repeated bloodlettings, and warm baths: occasional but very transient relief was obtained; the patient ultimately became delirious, and expired on the seventh day after admission. He repeatedly refused the offer made to him of amputation of the thumb, as the only chance which promised a prospect of arresting the disease, in its earlier stage. The thumb continued to suppurate moderately during the course of this fatal malady.]

Autopsy, thirty-four hours after death.—The rigidity of death was not very sensibly marked. The skin of the right thumb was stripped off, and two openings were apparent on its palmar surface opposite to the articulations: on raising the skin the flexor tendon was found softened and bathed in a sanious fluid; the ligaments and cartilages of the last phalangeal articulation were destroyed, and the surface of the bone was blackened. The nervous system was examined with care; but, with the exception of a slightly injected state of the cerebrum, cerebellum, and spinal marrow, no lesion nor alteration in structure could be detected.

CASE VI. *Dislocation of the second phalanx of the left thumb; phlegmonous inflammation; death, and autopsy.*—Auguste Desvaux, aged 28, a painter, applied at the Hôtel-Dieu for advice, in April, 1825. He was suffering from a dislocation of the ungual phalanx of the left thumb backwards, with a wound on its dorsal surface opposite the inferior extremity of the first phalanx: this accident had occurred twenty-four hours previously. After submitting to protracted and painful attempts at reduction, which at last proved successful, the patient was dressed and sent to bed. Very shortly afterwards evidences of phlegmonous inflammation were apparent in the thumb, which soon extended to the wrist, and thence up the fore-arm to the upper-arm, in spite of two general bleedings and the free application of leeches. The skin then passed into a state of gangrene, and the dislocated phalanx became detached. Copious suppuration followed, and more than half of the integument of the upper extremity sloughed: considerable general disturbance and febrile action accompanied this extensive mischief, and diarrhœa and dyspnœa supervened: the patient ultimately died delirious and exhausted at the close of the September following.[1]

Autopsy, forty-one hours after death.—The skin and aponeurosis of the left arm were entirely destroyed over the lower two thirds of the limb, with the exception of a small flap in front. The fore-arm was involved in this disorganization, and the muscles were laid bare, as if they had been dissected, the superficial nerves and veins having completely disappeared. The ungual phalanx of the thumb had separated, and the first phalanx was almost detached from the metacarpal bone: the radio-carpal articulation was bathed with pus; and in all the joints the cartilages were destroyed, and the bones were of a greyish colour and polished. The humero-cubital articulation contained about half an ounce of yellow serum. The pia mater of the brain was red and highly injected, especially over the right hemisphere; the brain itself was of a sable hue; the right corpus striatum was more vascular than the left; the ventricles contained an ounce of serum; and the substance of the brain generally was injected. Moreover, the stomach, intestines, and lungs presented manifest traces of inflammation.

Case VII. *Compound dislocation of the thumb; death, and*

---

[1] [The preceding account has, in this instance, been translated literally: it would have been more satisfactory to have known what was the constitution and what were the general habits of this patient, as well as some further account of the treatment, as more than five months elapsed between the accident and death. Antiphlogistic measures exclusively are scarcely ever admissible in these cases.—Tr.]

autopsy.—In January 1826, Léger, aged 36, a young woman of good constitution and living in the country, placed herself under the care of M. Roux. Three days previously she had fallen from her bed on the left thumb, the last phalanx of which was torn from its connexions and turned back on the first: the skin, the anterior ligament of the joint, and the flexor tendon were rent asunder, and the joint was laid open. She did not suffer much, and there were but little inflammation and swelling. On the following day, after some vain attempts at reduction, M. Roux decided on amputating the ungual phalanx: union by the first intention was not sought, but the hand was placed and kept in very cold water, which was frequently renewed. Three days afterwards the thumb became red, tense, and swollen, and the wrist was tender to the touch: forty leeches were applied. On the fifth day there was an extension of the swelling up the fore-arm; the leeches were repeated. On the sixth some pus began to flow; and on the seventh it was evident that inflammation was extending along the synovial sheath of the flexor tendon. On the eighth day the face expressed much suffering: tongue dry, pulse small; there was no distinct fluctuation, but compression about the wrist procured a copious discharge of pus. All the symptoms were aggravated on the ninth day, and an incision of three inches in length was made about the centre of the palmar surface of the fore-arm; this was carried down to the muscles before the matter escaped; and the muscles themselves bulged from the wound on the following day. There was, however, but little relief from this operation, and it was subsequently repeated: still the patient did not rally, and amputation was at last proposed as the only resource, but to this she would not submit, and she died at the expiration of three weeks.

Autopsy, two days after death.—The deep bed of the antibrachial muscles was dissected by the pus, but the bones were unchanged: the two rows of carpal bones were separated by pus, and their surface was necrosed: the synovial thecæ of the tendons were thickened and full of pus, of which there were also several deposits along the arm; the basilic and cephalic veins were also surrounded with matter, and their coats were thickened and much inflamed within, as high up as the subclavian; they also contained pus. There were old adhesions of the pleura, otherwise the viscera of the chest, head and abdomen, presented nothing unusual.

Case VIII. *Dislocation of the left thumb backwards; reduction; subsequent gangrene, and death; autopsy.*—J. B. Hude, aged 67, a hatter, in the enjoyment of good health, fell, whilst intoxicated, on his left thumb, and dislocated it. A surgeon was sent for, who employed great and prolonged violence in attempting the reduction, which he ultimately succeeded in effecting. But the parts had been so roughly treated, that they became painful, inflamed, and swollen; and very shortly the hand and wrist became excessively red and distended: this was the condition of the patient when he came to the Hôtel-Dieu eight days after the accident. Leeches were thrice freely applied, but without retarding the formation of matter; and the mischief extended up the fore-arm, and was accompanied by considerable fever. Several incisions were made to give free vent to the matter, but the inflammation still extended, and the thumb sloughed and separated at the metacarpo-phalangeal articulation. After this the patient sank into a state of great prostration, and was in a very precarious state for a fortnight, but then rallied a little: the suppuration, however, continued, and crepitus became distinct at the radio-carpal articulation, indicating that this joint was implicated in the mischief. This patient subsequently died at the close of the second month, completely worn out by his suffering, and exhausted by the continuous drain upon the system.

Autopsy.—The phalangeal extremity of the first metacarpal bone was denuded of its cartilage. There were four different abscesses in the fore-arm, beneath the skin, in the muscles, and communicating with the radio-carpal articulation: but the largest deposit of matter was amongst the tendons in the palm of the hand. All the joints between the bones of the fore-arm and metacarpal bones inclusive were deprived of their cartilage; but the compact tissue of the bones themselves was not altered: the ligaments supporting these joints were also for the most part destroyed, leaving the bones loose and movable on each other. The lungs were healthy. The left ventricle of the heart was hypertrophied and very contracted; and the aorta presented, through its whole length, patches of tenacious, yellowish deposit on its inner surface, the internal coat being destroyed opposite these points: this matter had not assumed at any part an osseous character. There were some traces of inflammation in the lower part of the small, and in the large intestine.

The first phalanx of the thumb may be dislocated in different ways, but the displacement backwards is the most frequent, and the only one likely to occur. The dislocation in question is usually caused by a fall forwards on the palm of the hand, when the weight is principally received by the anterior surface of the thumb: this circumstance has been noticed in nearly all the preceding cases. Some individuals are able to produce this dislocation at pleasure; and this power seems to be attributable to a peculiar conformation of the parts concerned, and the reduction of the displaced bone is effected with the same facility. The following are the signs of this dislocation; the thumb is shortened, and the phalanx extended at right angles on the metacarpal bone: this latter characteristic, however, is not invariably present, as was remarked in the second of the foregoing cases, in which the two bones were parallel: the luxated bone is quite immovable, and the metacarpal head forms a prominence on the anterior part of the articulation, whilst the ungual phalanx is flexed, and the skin which is thrown into transverse folds in abduction may present longitudinal wrinkles.

If left to itself this dislocation speedily becomes irreducible: in two out of the three examples given this was the case; it is, therefore, important to lose no time in restoring the displaced bone to its normal position. The best method of proceeding is to have the wrist fixed by an assistant, and to apply a ligature (tape) on the thumb, by which extension can be made: the latter is then to be flexed, at the same time that pressure is to be made from behind forwards on the extremity of the luxated phalanx, for the purpose of restoring it to its normal relation to the head of the metacarpal bone. It is important, after the reduction has been effected, to apply pads and a roller around the joint.

Dislocations of the ungual phalanx are even more rare than the preceding, as well as more difficult of reduction, on account of the small hold which is presented for the application of the extending force. The direction of the displacement is most commonly backwards, though it may be forwards, as the fourth case proves: this difference may be accounted for by the limited extent of surface which the first phalanx presents behind for articulation with the second. It would be superfluous to enumerate the signs of this dislocation, as they are so self-evident. The prognosis in this class of injuries is serious: thus, in the fourth case, although the reduction was easily effected, a white swelling followed inflammation of the joint. In the fifth and sixth cases, reduction was succeeded by tetanus and phlegmon, and they both terminated fatally; as also did cases seven and eight. The last-named dislocations, as well as the former, become speedily irreducible. To effect reduction the wrist should be fixed and a cord (or tape) attached to the displaced phalanx, by which the latter is to be extended: it is desirable at the same time to employ pressure to assist in restoring it to its normal position.[1]

DISLOCATIONS OF THE FINGERS.

Some persons of feeble muscular power, or at any rate having unusually weak ligaments, are able at will to dislocate the phalanges of the fingers from one another, and to reduce them by a contrary effort. These luxations are unimportant, except as indicating a want of natural support on the part of the ligaments, which is likely to be perpetuated by frequent repetition of this experiment, so as to weaken and otherwise interfere with the due and healthy functions of the articulations concerned.

In some instances these dislocations result from repeated acts of extension, such as are required in the exercise of certain handicrafts and trades; and they of course materially interfere with the pursuit of the calling, whatever it may be. The simple treatment in these cases is to interdict such abuse of the joints, in part or altogether; and to employ cold bathing, and astringent or even styptic lotions, with the view of restoring to the ligaments and other soft parts their natural properties of resistance. I have advantageously employed, in some of the more serious cases, a cylindrical piece of leather, fitting over the articulation and extending half an inch beyond it above and below, and admitting of being laced on one side. In some instances I have added small whalebone splints, adapted to the palmar and dorsal aspect of the finger, and received into sheaths worked on the outer surface of the above apparatus, or properly fitted into cloth (as in stays). The employment of these measures, if persevered in sufficiently long, has always had the effect of arresting the progress of the mischief, and sometimes of procuring a complete cure.

---

[1] [It can scarcely fail to strike the reader, as it has the translator, that the conclusions from the above cases have the *appearance* of a hasty generalization from a limited number of facts. The talented and experienced author must surely have selected the foregoing cases as illustrative of the serious consequences which *may* follow such accidents, rather than as examples of what is usually the case. It must, moreover, have fallen to the lot of many surgeons to reduce dislocations backwards of the ungual phalanx of the thumb without any extraneous aid, and without the subsequent occurrence of any untoward symptom.—Tr.]

Simple dislocation of the phalanges of the fingers upon one another, which at first sight appears to be an accident of no moment, is in reality one of considerable importance: and there are few surgeons who have had to deal with this kind of injury, who cannot but have observed that they are sometimes easy, and in other instances very difficult to treat, or even absolutely irreducible.

These dislocations are usually the consequence of falls on the points of the fingers, or, it may be, of some effort by which the fingers are forcibly extended: the base of the lower phalanx is thus thrown forwards, whilst the head of the upper one is carried backwards. The finger then remains fixed in an extended condition; and the prominence and depression, according anteriorly and posteriorly with the altered relation of the bones which constitute the articulation, are readily detected through the swollen soft parts. The rapidity with which the rigidity and tumefaction disappear (after reduction), together with the ready restoration of the healthy functions of the joint which has suffered this violence, naturally lead one to conclude that, for the most part, this dislocation is unaccompanied by laceration of the lateral ligaments and other fibrous textures which surround the joint: indeed, everything tends to prove that, in such cases, these accidents are scarcely more important in their results than where similar displacements are spontaneously produced.

Under ordinary circumstances, the reduction of this form of dislocation may be readily effected by fixing the finger with one hand, and extending the luxated phalanx with the other, taking care at the same time to flex the latter. If this should fail, the operator should press firmly with his thumb on the palmar surface and base of the dislocated phalanx, so as to force it from under the head of the upper phalanx into its proper position: this plan almost always succeeds.

But it would be a great error to suppose that dislocations of the phalanges from each other are always of so simple a character as those which have just been noticed, or that they are invariably so easy of reduction: on the contrary, it not unfrequently occurs that the cause which determines the luxation produces likewise laceration of the lateral ligaments, of the theca of the tendons, and even of the skin itself. Yet this complication of the injury, whatever may be its consequence, is not the most serious part of these dislocations; but that which constitutes both the danger, and the difficulty in the treatment, is the changed position of the flexor tendon. If the theca still incloses the tendon, and the latter follows the phalanx in the direction in which it is displaced, the reduction is usually by no means difficult, and the only consequences the injury entails are such as necessarily appertain to the lesion of the surrounding soft parts. But if, instead of retaining this relation to the luxated phalanx, the flexor tendon bursts its sheath and insinuates itself between the two articulating surfaces which are implicated in the mischief, then the reduction presents insuperable difficulties, which suffice to baffle the best directed efforts to overcome them: and I have seen surgeons of the greatest eminence, who were by no means in the habit of leaving things half done, obliged to abandon attempts which were alike futile in themselves and very painful to the patient. How are we to account for this singular difficulty? For some time I attributed it to the tension of the lateral ligaments, which, when not torn through, were violently put upon the stretch during the act of luxation, and then fixed the dislocated phalanx in its new position. But more recent observations have taught me that the obstacle in question, of which no sufficient explanation had been previously given, is not attributable to the resistance offered by the lateral ligaments, as they are almost always torn asunder, but to the interposition of the flexor tendon between the head of the upper phalanx and the base of that beneath it.

In such cases as the above, one might reasonably have anticipated that, by suitable manipulation, the displaced tendon could be brought back to its proper position; but, apart from the difficulty of ascertaining in which direction the displacement has taken place, experience proves that no movements, whether lateral or otherwise, are of any avail in disengaging the tendon from its abnormal relation to the articulating surfaces. I am acquainted with but one method by which the reduction can be accomplished,—a harsh alternative certainly, but at the same time preferable to the persistence of the dislocation and to the consequences which may spring therefrom: this measure is section of the flexor tendon above the luxated joint: all resistance then ceases, and every obstacle to reduction is at once removed.

CHAPTER X.

ORIGINAL OR CONGENITAL DISPLACEMENT OF THE HEADS OF THIGH-BONES.

There is a species of displacement of the upper extremity of the femur, of which I have not found any mention in authors, although I have carefully sought for it: and in directing attention to this subject, I have been prompted by a desire to guard practitioners against a serious error in diagnosis and treatment, rather than by the melancholy satisfaction of adding one more item to the already too extended catalogue of human infirmities.

This displacement consists in a transposition of the head of the femur, from the cotyloid cavity on to the external iliac fossa (dorsum) of the ilium, a transposition which exists at birth, and which appears due to a defect in the depth or completeness of the acetabulum, rather than to accident or disease. The class of dislocations to which it belongs is that in which the bone is thrown upwards and outwards. There are already described two species or varieties of this disease, viz. accidental dislocation, and consecutive, spontaneous or symptomatic dislocation. That species of which I am about to speak constitutes a third variety, which I shall name *original or congenital dislocation*, to distinguish it from the two forms which I have mentioned above.

This dislocation possesses characters common to all those in which the head of the femur is carried upwards and outwards, viz.: shortening of the affected limb, the position of the head of the femur in the external iliac fossa, the prominence of the great trochanter; the retraction of nearly all the muscles of the upper part of the thigh towards the crest of the ilium, where they form, around the head of the bone, a sort of cone, of which the base is at the ilium, and the apex at the great trochanter; the almost denuded state of the tuber ischii, abandoned by its muscles; together with rotation of the limb inwards, by which the popliteal region and heel are directed outwards, and the knee and foot inwards: also an obliquity of the thigh in a direction from above downwards and inwards, which becomes more decided as the age of the subject approaches the adult period, and the pelvis becomes correspondingly developed: lastly, an acute re-entrant angle at the junction of the inner part of the thigh with the pelvis, and wasting of the muscles of the whole limb, especially at its upper part, complete the list of signs by which this abnormal condition may be recognized.

In studying the individual movements of a limb thus affected, they are observed to be very limited, and especially so those of abduction and rotation, which accounts for the numberless difficulties experienced in the acts of locomotion and various exercises which the lower limbs are required to take part in. If, again, the form and development of those who are the subjects of this congenital deformity are examined, the beholder is at once struck with the want of proportion between the upper and lower parts of the body, with the imperfection of the lower extremities, and with the attitude of the individuals. In fact, the trunk is very much developed, whilst the lower limbs are short and meagre, as if they belonged to a person of smaller stature. These peculiarities in the abdominal extremities are rendered still more striking by the breadth of the pelvis, which corresponds in external development to the trunk: moreover, the prominence of the great trochanters, with the obliquity of the thighs and inversion of the entire limbs, characterize the defect in question.

As to the attitude of the individuals who are the subjects of this deformity, the upper part of the trunk is carried very much backwards, whilst the lumbar region is hollowed behind and projects in front: the pelvis is placed almost horizontally on the thigh-bones, and the points of the feet alone touch the ground; which circumstances are evidently attributable to the transposition of the ilio-femoral articulation and the centre of motion (or of gravity) to points posterior to those which they would naturally occupy.

In walking, persons thus deformed step on the points of the feet, alternately inclining the trunk very much towards the limb on which the weight of the body is thrown; at the same time that the opposite extremity is raised from the ground, and in its turn receives the superincumbent weight, which is thus laboriously transferred from side to side. Indeed, each time that this effort is made, the head of the femur which receives the weight of the body is seen to rise distinctly on the external iliac fossa, whilst the pelvis descends and all the signs of dislocation become more marked on that side, and less apparent on the other, until the translation of the weight to the opposite limb converts the above conditions. The toilsome nature of these efforts in progression are clearly due to the instability of the heads of the thigh-bones, which, in consequence of their being thrown out of their natural and fixed cavities, are subject to continual displacement, alternately rising and falling as they are charged with, or relieved from, the superincumbent weight of the body.

The labour with which these individuals walk would naturally lead one to expect that the acts of running and leaping would be still more difficult to them: yet this is not so; for in executing these efforts the energy of the muscular contraction, and the rapidity with which the weight of the body is transmitted from one limb to the other, render the effects arising from the unstable condition of the heads of the thigh-bones almost inapparent. It is true that there is an unusual rocking or swaying motion of the upper parts of the body, and that the pelvis seems to describe, in its movements from side to side, a larger segment of a circle than naturally; in a word, the effort of transferring the weight of the body from one limb to the other is evidently laborious: but even these signs of defect generally become even less manifest in the act of leaping, which is executed in some measure as in certain animals unprovided with limbs,—the body being first curved and then suddenly straightened with a jerk, so as to dart the body to a height or distance. These acts are, however, at best of so toilsome a nature, as scarcely to permit the subjects of this congenital defect to pursue them for any protracted period: the displacement and rubbing of the heads of the thigh-bones, the inconvenient swaying of the body in walking, and the great muscular efforts in running and leaping, do not fail to produce fatigue which necessitates early repose; and this weariness is more speedily entailed when the weight of the upper part of the body is great.

When these individuals lie horizontally on their backs, one is surprised to observe that the signs of the deformity are much less apparent than in the erect posture: this must be attributable to the repose of the muscles, which cease to draw upwards the thigh-bones; and to the mode in which the pelvis is, as it were, wedged in between the heads of these bones.

There is one point which incontrovertibly proves the correctness of the explanation I have given of the nature of the infirmity in question; it is that, whilst the body is recumbent, the affected limb may be lengthened or shortened at pleasure. Very slight extension or pressure is sufficient to render apparent these variations in the length of the limbs; and if the crest of the ilium and summit of the trochanter are selected as points by which to judge of the amount of change, it is easily ascertained that it varies from two to three inches, according to the age, size and development of individuals, and chiefly according to the extent of displacement of the bones: and the signs of dislocation may be rendered more or less distinct in a few moments, by alternately lengthening and shortening the limb. In fine, all these changes of position may be produced with the greatest facility and without occasioning the slightest pain, so as to leave no doubt respecting the entire absence of disease, as well as the non-existence of any especial cavities appropriated to receive and retain the heads of the thigh-bones. Such is the condition of persons affected with this congenital dislocation.[1]

Whatever importance may be attached to this dislocation in the abstract, it is deserving of still more attention on account of its presenting all the signs of luxation consequent on disease of the hip-joint, with which it has always been confounded; and the same treatment has been adopted to remedy that which in reality is at most but an infirmity, and has nothing in common with the displacement consecutive on disease. In consequence of this error in diagnosis, I have seen some individuals affected with this original deformity subjected to the restraint of being confined to their beds for years together; others I have seen forced to submit to the application of leeches, blisters, cautery and moxas, without number: and one case in particular I can call to mind, amongst the many victims of this blunder; it was that of a young girl on whom her attendants had, in their blind ignorance, inflicted the suffering of twenty-one moxas about the hips; and, as might have been anticipated, without this barbarous and useless treatment having the slightest beneficial effect on the unfortunate patient. It has occurred to me to witness an instance, in which the patients unjustly accused their nurse of having carelessly or brutally caused dislocation in their infant; whereas, the truth was that the deformity was congenital. A still more remarkable case fell under my observation about fifteen years since: an individual of the name of Autun was barbarously assassinated, and his mutilated and disfigured corpse, which was found inclosed in a sack, remained for a long time unrecognized in spite of the most active investigation, until I remarked the peculiarity indicating the deformity I have been describing; this I made known in the proper quarters, and the information led to the body being identified. When careful inquiry was subsequently made into the history of this individual's life, it was ascertained that he had never suffered from disease of the hip-joints, but that he had come into the world with the defect which contributed to the recognition of his body; notwithstanding the horrible way in which it had been mutilated by the murderer, in the hope of thus preventing the identification of his victim.

---

[1] [The cast of a young man, aged 18, the subject of this congenital deformity, was taken during the summer of 1844, at St. Thomas's Hospital, by Mr. Kearney, and is in the Museum of that institution. The leading features of the graphic description in the text are illustrated and confirmed by this case, with these exceptions, that the young man walks fairly on the soles of the feet, and that the limbs are not inverted. A report of this well-marked instance of congenital dislocation of the heads of thigh-bones will be found in the first volume of the Lancet, new series, p. 781.—Tr.]

The entire absence of pain, swelling, abscess, fistula, or cicatrix; the simultaneous existence of dislocation on both sides; the history of the individuals thus affected; together with the progressive development of the signs which characterize this deformity, from the time that the feet first touch the ground, until the increasing weight of the body is wholly supported on the lower extremities at a later period,—are so many certain indications by which to distinguish these two affections, (congenital and consecutive dislocation); which, though so analogous in their signs, offer so many points of contrast as to their origin, nature and appropriate treatment.

The subjects of this original defect suffer no pain either in the hips or knees; indeed, the only local sensation of which they are conscious is that of fatigue and numbness when they have exercised the lower limbs too much. There is no morbid swelling about the ilio-femoral articulation in these cases; for the prominence of the great trochanter and fulness of the muscles about the neck of the femur are not of this character, but are only the natural effect of the abnormal position of the head of this bone; and there are neither abscesses nor indications of there ever having existed any in the neighbourhood of the joint. Lastly, the exactly similar alteration in form which is always observed in both hips, may be almost regarded as exclusively characteristic of the congenital affection, so extremely rare is this circumstance in cases where the dislocation is consequent on disease. The history which is always given with these cases entirely confirms the above observations; for it does not include any of those marked symptoms which characterize that painful and cruel disease of the hip-joint, which usually issues in spontaneous dislocation of the femur.

A careful investigation into the history of these cases does not lead to a negative result only, but it is likewise positively available, by putting us in possession of the first signs, the progress, the development and the effects of congenital dislocation of the thigh-bones. If a practitioner is called in at an early period, to see an infant thus affected, certain indications of this deformity may be detected immediately after birth; such, for instance, as immoderate breadth of the hips, prominence of the trochanters, obliquity of the ossa femoris, &c.: but, as it almost always happens that any vicious conformation, and the infirmities which spring therefrom do not attract the attention of parents until the children first attempt to walk, it is at this period that surgeons are, in most instances, called upon to establish the existence of the defect. Then the little patients experience considerable difficulty in walking or running, or even in sustaining the weight of the body in the upright posture: but sometimes it even happens that parents, from carelessness or inattention, imagine that their children are only backward in walking, and do not discover the deformity until three or four years have elapsed, that is, until the defects and imperfections in the form and motions of the parts have become so manifest, that they can no longer be reasonably attributed to retarded development.

It is especially when the pelvis begins to expand, and when the child begins to join in protracted and fatiguing exercises, that the evil becomes more apparent still: then the swinging or see-saw motion of the upper part of the body, with its inclination forwards, the unusual bend in the back and corresponding prominence of the belly; the curved motion of the extremities, and mobility of the heads of the thigh-bones, &c., begin to exhibit themselves very decidedly; but the cause and nature of these signs are unintelligible even to many medical practitioners. Some attribute the defect to an accidental fall from the cradle or the nurse's arms, or to the habit of lifting the child by the legs or thighs; others ascribe it to a scrofulous affection, by which, either before or after birth, the margin of the acetabulum or head of the femur has been so far altered in form as to entail dislocation. It must be admitted that this latter notion receives some support from the fact that the subjects of this affection are frequently of a lymphatic constitution and rickety appearance; and if I cannot myself subscribe to the opinion, it is because I have observed this vicious conformation in infants of a diametrically opposite constitution even at birth, and in whom there was not a single indication of disease: but I have been led to think otherwise, especially because I have had the opportunity of dissecting the affected parts, and have found their form and organization such as to exclude the idea of either existing or prior disease.

At a still more advanced period, that is to say, when each sex begins to assume a distinctive form, the development of the pelvis, which is both greater and more rapid in girls than in boys, renders the effects of the peculiarity in question more striking in the former: but when the growth is completed, and the body has attained its full weight, then the most careless attention is fixed, and doubts, if any still exist, are removed; for all the signs which have been already enumerated become so exaggerated that they cannot fail to strike the observer. All this is the natural and necessary consequence of the increased transverse diameter of the pelvis and augmented superincumbent weight. The upper parts of the body, pressing heavily on an articulation without a cavity, stretch the ligaments and fatigue the muscles, so as to force the heads of the thigh-bones towards the crests of the ilia; and such is the extent of this ascent, that I have in some instances seen the trochanters and heads of the thigh-bones attain an elevation, in the course of time, so as almost to touch the iliac crests. Moreover, the breadth of the pelvis, especially in women, by augmenting the interval between the heads of the ossa femoris, increases likewise the obliquity of these bones, and thus renders the defects arising from the absence of a fixed articulation still more palpable and mortifying. Thus I have known individuals who, as young girls, could walk, run and dance; but who, when full-grown, became almost entirely incapacitated for any violent exercise: and this difficulty becomes converted into an absolute impossibility in very stout persons, or in those who are dropsical or in the family way.

One point worthy of remark is that the state of things on the outside of the pelvis does not in the least influence the development of this part of the trunk; and that before puberty, throughout this period and after it is passed, the pelvis acquires dimensions which are most favorable to the perfect and healthy performance of the functions of the viscera which it contains; and that it is as fully competent to receive, retain and transmit the product of fecundation, as in persons of entirely natural conformation.

The opportunities of determining, by post-mortem examination, the nature of this singular species of dislocation are very rare; for, as it neither constitutes, nor gives rise to, disease, and is only an infirmity in no way involving the safety or threatening the life of the subject of it, I have been enabled to study it in only a few instances, where accident or disease unconnected with the deformity have placed individuals thus affected within my reach. The appearances I have found in such subjects are the following: All the muscles which have their attachment either above or below the acetabulum were drawn up towards the crest of the ilium. Amongst these muscles some were well developed, whilst others were attenuated and slightly atrophied; the former were those which had preserved their action, the latter those the action of which had been cramped and limited, or even entirely negatived by the altered relation of their attachments. Of the latter class some few were reduced to a sort of yellowish *fibrous* tissue, amid which the eye sought in vain for any trace of *muscular* fibre.

The upper part of the thigh preserves, in these cases, its natural form and dimensions, with the single exception of the upper and inner part of the head of this bone, which I have remarked has sometimes lost a little of its roundness, a circumstance which appears due to the friction it has been subjected to, by contact with a surface unsuited for articulation. The cotyloid cavity is either altogether absent, or presents only a small osseous, irregular prominence, where neither trace of diarthrodial cartilage nor vestige of synovial or other capsule, nor fibrous margin is to be found; but which is surrounded by some tough cellular tissue, and covered by the muscles which are inserted into the smaller trochanter. Once, in two or three subjects which have been submitted for my examination, I met with the round ligament of the joint very much elongated, flattened above and, as it were, worn at certain points by the pressure and friction of the head of the femur.

The head of the bone itself is lodged in a hollow, somewhat analogous to that which is developed around it in accidental dislocations upwards and outwards which have remained unreduced. This new cavity, which is very superficial and almost without a rim, is situated in the external iliac fossa, that is to say, above and behind the acetabulum, at an elevation proportioned to the shortening of the limb, or to the ascent of the head of the femur, which amounts to the same thing. In fact, the only perceptible difference in this respect, that I have been able to detect between these congenital cases, and accidental dislocations of old date or those which were spontaneous, is that, in the former, the arrangement of the parts appears to have subsisted for a longer term, and gives the impression of its having been the primitive condition, or that which was assumed at the very earliest period of existence.

What then can account for a dislocation, of which neither disease nor violence can be assigned as the cause, at least as far as observation can inform us? Can it be the result of a disease affecting the infant whilst still in its mother's womb, but cured before its birth? or may external violence or muscular effort produce the displacement of the head of the femur, and a natural process of obliteration remove the traces of the then useless acetabulum? or lastly, does nature forget her work, and leave the head of the femur unprovided with a cavity to play in; or, as M. Breschet thinks, does some obstacle to the normal evolution of the bones constituting the acetabulum render this cavity imperfect? To these difficult questions I have no solution of my own to offer; but I shall confine myself to some brief remarks on each of the explanations which I have just noticed.

It is well known that the fœtus in utero is subject to several diseases, which may run their course, and terminate either by recovery or death before the term of gestation is completed. It is, therefore, within the range of possibility that some disease entailing spontaneous dislocation of the femur may account for this congenital condition: yet there are several circumstances which seem to be repugnant to this explanation; and first of all, in every case in which this displacement has been observed, the subject of it has been in perfect health when brought into the world, which one would scarcely suppose probable, if a disease involving such important consequences had pre-existed; and moreover, none of the usual evidences of such disease, in the form of swelling, fistulas, pain, &c., have been noticed either at the birth or afterwards.

Is it not more probable that this displacement is accidental, and analogous in its nature, if not in its special cause, to those dislocations which occur during life from falls, blows, &c.? But what, it may be asked again in answer to this hypothesis, could have been the effort or violence to have produced such a displacement? I will take the liberty of throwing out a remark which may, in some measure, be considered as supporting this explanation; it is this. The position of the lower extremities of the fœtus in utero is such, that the thighs are very much bent on the belly, from which it follows that the heads of the thigh-bones are continuously pressing against the lower and back part of the capsular ligament;—a circumstance which, though without effect in well-formed individuals, might, I apprehend, have an injurious influence in such as are weak, or of lax, unresisting fibre. If this premise is conceded, there is not much difficulty in imagining that dislocation may result; and the supposition is further strengthened by the fact that the most powerful of the muscles surrounding the articulation have a constant tendency to draw upwards the heads of the thigh-bones, as soon as they escape from the acetabula.

Lastly, does this condition depend on faulty development of the ossa ilii? M. Breschet is of opinion, from his own researches and those of many modern anatomists on the evolution of the osseous system in the embryo and fœtus, that the points the development of which is longest delayed, are those where cavities or eminences are intended to exist, and more particularly those where several portions of bone coalesce: thus, it is at those central points of ultimate union towards which different osseous fibres are radiating, that the vices of conformation arising from arrested development are met with. Now, the acetabulum is constituted by the union of three bones, and its formation is known to belong to one of the latest periods of ossification: the pelvis also is tardily developed. Further, the pelvis itself and the viscera it encloses receive their vascular supply distinct from that of the lower extremities, for the arteries of the latter may be fairly considered as a continuation of the main arterial trunk: it may, therefore, happen from some hitherto unknown cause, that the development of the pelvis may be retarded instead of proceeding *pari passu* with that of the thigh-bones; and then these bones would be carried to the most depressed part of the outer surface of the ilium, that is, they would take up their position in the external iliac fossæ.[1]

The preceding three hypotheses can only apply to that form of dislocation which is observed at birth; but there is another form which is original, and coeval with the earliest organization of the parts. Whatever some physiologists may have said, there are certain vices of conformation which are altogether original, and are referable to a defect in the organization of the germs. May not the deformity of which we have been speaking appertain to this class? In adopting this hypothesis, a ready explanation of the simultaneous dislocation of (in most instances) both thigh-bones is afforded; and the perfect health at birth of the subjects of this affection, together with the entire absence of any evidence or symptom of disease, past or present, in or around the articulation, would serve to confirm the probability of this suggestion.[1]

---

[1] [This conclusion does not seem to be a necessary inference from the preceding reasoning; at any rate the argument is far-fetched, as it is difficult to conceive of the thigh-bones extending themselves with such rapidity as to grow out of their sockets and on to the dorsum ilii. Moreover, it involves a *petitio principii*, as the source of vascular supply to the thighs and pelvis can scarcely be called distinct.—Tr.]

However this may be, one might find a satisfactory equivalent for one's ignorance of the cause of these dislocations, in the means of remedying their effects, if such existed: but unfortunately this also is denied us, for the deformity is incurable. Of what possible utility can it be to practise extension of the lower extremities in these cases, even supposing the limbs could be thus brought to their natural length? Is it not evident that the head of the femur, finding no cavity fitted to receive and hold it, would, when abandoned to itself, resume its former abnormal position? There is something more rational and feasible in adopting a palliative course of treatment. When we call to mind the natural proneness which the heads of the thigh-bones have to ascend to the external iliac fossæ, and that this tendency is partly due to the superincumbent weight of the body, and in part to muscular action, a just conception may be formed of the indications on which the employment of palliative remedies should be founded. The object should be to relieve the lower limbs of the superincumbent weight on the one hand, and on the other to moderate the muscular action. Both of these indications are in part fulfilled by repose; and the attitude most conducive to this effect is the sitting posture, in which the weight of the upper part of the body is not transmitted to the lower extremities, but is centred in the tuberosities of the ischia. Therefore, labouring persons afflicted with this infirmity should be recommended to adopt a sedentary occupation; as a calling which requires much standing and walking about would dangerously aggravate their deformity.

---

[1] [Is it unreasonable to suppose that this deformity may be referred to the same category with other original distortions of the joints, dependent apparently on muscular spasm? In many cases of club-foot and similar congenital affections, there can be little doubt that some organic or functional lesion of the true spinal centre is the source of the mischief, which is frequently symmetrical.—Tr.]

Yet one would scarcely be willing to condemn such individuals to perpetual repose; and to avoid this it is necessary to discover some means for diminishing the inconveniences which attend the upright posture, the act of walking and other exercises. Experience has taught me hitherto but two methods of attaining this important object: the first consists in the daily employment of a perfectly cold bath, in which all the body should be immersed for the space of three or four minutes, the head being protected by an oiled-silk cap: the water may be fresh or salt; and the only precautions necessary to take are to avoid bathing when the body is in a state of perspiration, or when the catamenial discharge is present. These baths have a local as well as general tonic effect. The second method consists in the constant use, at least during the day, of a belt which embraces the pelvis, fitting closely over the great trochanters, and keeping them at a constant height, so as to bind the parts together, and prevent that continual unsteadiness of the body which results from the loose connexions of the heads of the thigh-bones. For the proper fulfilment of these indications, certain precautions are necessary in the construction of this cincture: in the first place it should occupy the narrow interval between the crest of the ilium and great trochanters, completely filling this space, and therefore being about three or four fingers' breadth, according to the age and size of the patient. It should further be well padded with wool or cotton and covered with doe-skin, so that it may not abrade the parts to which it is applied; and there should be a piece let in on either side so as to receive and support the trochanters without entirely covering them: it should be buckled behind, and padded straps should be carried under the thigh and across the tuberosity of the ischium on either side, to prevent the zone from slipping up. I do not mean to assert that I have ever succeeded in completely getting rid of the inconveniences of congenital dislocation of the thigh-bones, but I have prevented their increasing, and have rendered supportable what I could not cure. The testimony of some patients to the value of this treatment has been of a most unequivocal character; for, being worried by the pressure of the belt, they have laid it aside, but have speedily resorted to it again, as they found that without it they had neither a sense of firmness in the hip, nor confidence in walking.

Before I conclude these observations I must remark that original or congenital dislocation of the thigh-bones is not so rare as may be supposed. I have met with as many as twenty cases in the course of eighteen years. One final remark, which is not without its interest, is, that almost all the individuals who are affected with this deformity are females: indeed, out of twenty-six cases which I have examined, not more than two or three at most were males. One would scarcely be disposed to attribute this disproportion solely to chance, although it is true that we are often misled in our calculations and generalizations, by trusting too confidently to apparently sound data: but in regarding the above numerical disparity as constant, it is difficult to assign any satisfactory reason why females should be so much more liable to congenital dislocation than males. I confess, indeed, that I am wholly unprepared to hazard an opinion respecting the specific cause; and the only general explanation which I can offer is, that vices of conformation are universally admitted to be more prevalent in the female than the male sex. I trust that the observations of others may, at some future period, furnish an interpretation of this phenomenon, and complete that which I have failed to establish in the history of this singular affection.

CASE I. *Original dislocation of the ossa femoris. Retention of urine, terminating fatally; autopsy.*—A man, 74 years of age, suffering from retention of urine, was admitted into the Hôtel-Dieu in February 1828. Several attempts had been made by different surgeons to pass a catheter, and M. Breschet had succeeded once, but failed a second time. I may just remark, in passing, that this case afforded an illustration of the importance of carrying the catheter along the upper wall of the urethra, to avoid the false passages, constrictions, and obstacles which are almost always found to exist at the lower part of this passage. On the admission of this patient, it was anticipated that he would not long survive, and as there were several peculiarities which suggested the probability of there being congenital dislocation of the thigh-bones, I felt considerable interest in the examination of the body, which the patient's death shortly afterwards afforded me an opportunity of prosecuting.

Autopsy.—In the first place it was observed that the thighs could not be separated as in abduction, without making them describe a segment of a large circle: the trochanters were much nearer to the crests of the ilia, and higher than natural; the heads of the bones were very much elevated, the knees inverted and the thighs shortened; in fact, there was a total change in the relations, direction, and length of the limb. This was the consequence of the cavity destined by nature to receive the head of the bone being almost effaced, and of the latter being deformed. The upper part of each thigh was enlarged, the trunk curved backwards, and the belly protruded; the pelvis had almost lost the oblique bearing which is natural to it; the thighs were shortened, and the buttocks soft and flabby, which was explained by the approximated attachments of the great gluteal muscles, and the consequently relaxed condition of their intermediate bellies. The gluteus medius was, on the contrary, distended and raised up, the gluteus minimus entirely wasted, and the pyramidalis, instead of being oblique in its direction as is normally the case, was quite horizontal: the gemelli and quadratus were distended, and the adductors were abridged of their natural length.

On the left side, the original cavity did not measure more than an inch at its greatest diameter; it was very shallow, rugged, and filled with a fatty substance of a yellowish colour, and almost of the fluidity of oil; its form was nearly an oval. The external iliac fossa presented, in front of the sciatic notch, a broad, shallow depression, lined by a thick glistening periosteum, which had almost the appearance of articular cartilage: it was on this that the head of the femur rested. The last-mentioned process itself was diminished in volume, a little flattened, irregular, and without any vestige to mark the attachment of the round ligament; it was, nevertheless, invested by articular cartilage which was thinner than natural. The fibrous capsule of the joint, which was in form exactly like a purse, was attached to the upper and lower borders of the original acetabulum, and was in place of an osseous cavity on the side it covered; its length was sufficient to allow the ascent of the head of the femur to the depression I have just described: the space over which it extended amounted to about three inches. This capsule was very thick, and almost as dense as cartilage.

On the right side, the original cavity was a little larger, but its interior presented the same appearance as the other. The external iliac fossa, instead of exhibiting, as on the opposite side, a simple depression, presented, in front of the great sciatic notch, and nearly on a level with the space between the two anterior iliac spines, a broad and deep depression, with an osseous margin which was strongly marked, rough, and irregular. The head of the femur, which was larger than that of the other side, had likewise more nearly preserved its natural shape; but it was, as the left, invested by an imperfect articular cartilage, and both surfaces of the articulation were covered by synovial membrane. The orbicular ligament was not so thick as that of the opposite side, although its extent was not strictly limited to that of the circumference of the abnormal cavity. On this (the right) side, the head of the femur was supported by the osseous margin, whereas, on the left, the fibrous capsule was the only structure which, by its great strength and resistance, was effectively opposed to the weight of the body.

In addition to the above peculiarities there was very unusual mobility at the lumbo-sacral articulation; so that when the lower extremities and pelvis were fixed, the vertebral column could be moved freely upon the latter. The lax state of the intervertebral fibro-cartilage was the only recognisable cause of this singular mobility.

Case II. *Congenital dislocation of the ossa femoris. Chronic ophthalmia.*—Joseph Paquier, aged 49, a weaver, was admitted into the Hôtel-Dieu in 1831, for chronic ophthalmia, which he had suffered from, more or less, since infancy. Being relieved by the treatment adopted, and on the point of leaving the hospital, he asked for a truss to support a large scrotal hernia under which he was labouring. When I proceeded to examine him to satisfy myself of the existence of this complaint, I was not a little surprised to discover that the heads of the thigh-bones, instead of occupying their normal position, were in the external iliac fossæ. This transposition was characterized by shortening of the lower extremities, the elevated position of the heads of the ossa femoris, prominence of the great trochanters, retraction of the glutei muscles towards the crests of the ilia, &c. The disproportion between the upper and lower parts of the body was very remarkable: the trunk was developed, whereas the lower extremities were short and thin, especially when compared with the pelvis which was of the ordinary size. In the upright posture, the upper part of the trunk was thrown very much backwards; the position of the pelvis was nearly horizontal in relation to the thigh-bones, and the patient touched the ground with the points only of the feet. If he wished to get on horseback, he did so with great difficulty, and assisted himself with a chair: and when mounted he could only keep his seat by having the stirrup-leathers so short as to bring his knees on the same level with the great trochanters, and by resting on the ischia: he was unable to press the horse's flanks with his thighs. His walk was laborious and unsteady; at each step the head of the femur on which the weight was thrown could be observed to rise in the external iliac fossa, whilst the pelvis descended, which circumstances were evidently dependent on there being no fixed cavity for the reception of the heads of the thigh-bones: he wore, with good effect, a belt around the pelvis. In running he laboured less, and the unsteadiness was less remarkable. The affected limbs could be elongated or shortened, either by gentle extension, or flexing the thighs on the pelvis; and this could be accomplished without occasioning the slightest pain, so that there could be no doubt respecting the absence of cavities suited to receive and retain the heads of the thigh-bones. On being questioned, this patient affirmed that he was born with this deformity, and that he had always walked as he did when in the hospital.

By the side of this characteristic specimen of double dislocation of the thigh-bones, I will adduce another very curious instance, which seems to prove that this vicious conformation may be transmitted through several successive generations.

Case III. *Hereditary congenital dislocation of the heads of the ossa femoris.*—There exists in the town of Mantua (says M. Maissiat, the author of this communication) a family, many members of which have been and still are the subjects of congenital dislocation of the thigh-bones. The oldest individual in this family is a woman, 80 years of age, named Margaret Gardas, a fruit-vender; and the following is the account she gives, which has been corroborated by other persons of the same age.

Two of her aunts on the mother's side, who died at the age of 70, were lame from their earliest infancy; their hips were very high, large, and abruptly prominent, and they walked with their shoulders thrown back and waddling like ducks. The father of Margaret had a sister who was lame from her birth on the right side only; she died at the age of 80. Another sister, who was herself well-formed, gave birth to a girl, whose right leg was shorter than the left.

Margaret Gardas, who is the particular subject of this notice, is a large, robust woman, very fat, and giving the impression of having been a very smart, active person when young. In her the deformity did not make its appearance until she had attained her thirtieth year, and the signs are those of a spontaneous dislocation of the femur. The diameter of the affected limb is as much as a fourth part less than than that of the opposite; and it is three or four lines longer. This woman married a foreigner who was well formed, and by him had a daughter, who was born with the right lower extremity shorter by about three inches than the left. This daughter likewise married a well-made man, but whose father had congenital dislocation of both thigh-bones: she had four children, two of whom presented this hereditary infirmity: one of these was a girl 23 years of age, in whom the head of each femur occupied the external iliac fossa; the other was two years younger, and had the left hip alone dislocated. In this last case the affected limb was quite five inches shorter than the sound one; the head of the femur was situated above and behind its natural position, the great trochanter projecting forwards and outwards, and the point of the foot being inverted: but here both limbs were in other respects equally well developed.

Case IV. *Congenital dislocation of the right femur.*—Miss F., aged 8 years, of feeble constitution and lymphatic temperament, came to consult me at the Hôtel-Dieu in 1821. Her parents affirmed that she halted as soon as she began to walk: she had never had a fall nor received a blow on the hip whilst she was at the breast. Various methods of treatment had been devised and adopted, but without any effect. When this little girl was standing, the slenderness of the left lower extremity was apparent, as well as the contrast in their form and volume between the two sides of the buttock, the left being expanded and full above, but rounded below: the prominence of the great trochanter in a direction upwards and outwards, and the obliquity of the femur (on the affected side) were also striking. The spinal column presented a marked curvature, and the head was carried back to compensate for the effects produced by the transposition of the centre of gravity and motion: the abdomen also was prominent, and the knee and point of the foot were directed inwards, whilst the heel and popliteal region faced outwards. When Miss F. walked, she appeared, as it were, to transfer the trunk from one hip to the other; and she could not run nor jump but with great difficulty. In short, the case was evidently one of congenital dislocation of the femur, and was remarkable as presenting an example of this deformity on one side only.

Out of the twenty-six cases of this affection which have come under my notice, I remember only two or three similar to the above, i. e. in which the vicious conformation was confined to one side. I recollect one little child in particular who presented this abnormal condition on the right side alone; and what rendered this case still more interesting was, that he had a sister similarly affected, in whom likewise the right hip only was dislocated.

Case V. *Congenital dislocation of the thigh-bones.*—Miss T. de J. was born at the full period in January, 1812. At the moment of her birth nothing abnormal in the conformation of the lower extremities was observed. When six months old she had a bad eruption on the head, which, however, did not last long; and a month later she had the croup: dentition proceeded regularly and without the occurrence of anything worthy of notice. When she was fourteen months of age she was first put on her feet; and then, for the first time, her parents perceived that, in attempting to walk, the child shifted the weight of the body from one hip to the other with a swinging movement, and rested on the points of the feet, which, as well as the knees, were inverted, whilst the popliteal region and heel of either side were elevated and directed outwards: the little patient had considerable difficulty in raising the feet from the ground, and was scarcely able to separate the thighs from one another. The parents immediately had recourse to medical assistance, and consulted a great many practitioners, who advised and employed a multitude of remedies without the slightest advantage being derived: aromatic fumigations, friction, lotions, bathing, and tonic remedies generally were alike found unavailing. These measures, however, were persevered in; and as the child grew, so, *pari passu*, waxed the deformity: the lumbar region projected forwards, and, as a necessary consequence, the belly protruded.

In 1821 the child, who was then 9 years old, was brought to me, when the following appearances presented themselves. The lower extremities were inverted, short and meagre: their position was oblique, so as nearly to cross each other below. The great trochanters projected upwards and backwards, and the feet were very much curved: both chest and belly were prominent, and the upper part of the body was carried forwards; otherwise the trunk, and especially the pelvis, were well developed. There was not the slightest external indication of disease having at any previous time existed in or about the hip-joint; and this negative evidence was confirmed by the statement of the parents. The above symptoms were apparent whilst the patient was in the erect posture; but disappeared as soon as the lower limbs were relieved of the superincumbent weight by the reclining position. One remarkable feature in this case was, that Miss T. could walk, run, and jump, as any other child would do.

I at first thought that no benefit would be derived in these cases from the employment of continued traction on the lower extremities, for reasons already stated; but the experiments of MM. Lafond and Duval tend to throw some doubt on the correctness of this conclusion. These distinguished practitioners tested the influence of extension, in their orthopedic institution, on a child 8 or 9 years of age, who was the subject of double congenital dislocation of the hip; and after the uninterrupted employment of this treatment for some weeks, I satisfied myself that the limbs had resumed their natural length and direction;

but I was not a little astonished to find that, after extension had been persisted in for three or four months continuously, the greater part of the beneficial results remained for several weeks undiminished. It would be idle, it is true, to generalize on this single case; but, as an isolated example of the utility of extension, it is interesting, and it may be the forerunner of more important results. The following case, illustrative of a similar plan of treatment, has been supplied by the practice of M. Jalade Lafond.[1]

Case VI. *Congenital dislocation of the heads of the thigh-bones, treated by extension.*—Miss A., aged 9, was brought (says M. J. L.) to my establishment in 1828, under the following circumstances. She was of the ordinary stature at her age, well made generally, and in the enjoyment of good health. The curvature of the loins, the prominence of the gluteal regions, and the swinging motion of her body when she walked, put me in mind of the waddling of a duck: independently of this, she had very little stability either in standing or walking. On examining the hips, I remarked that the buttocks were prominent, the great trochanters being approximated to each anterior superior iliac spine; and when either foot was everted, a hard tumour, which was evidently the head of the bone, could be felt in the corresponding external iliac fossa: in the ordinary state, however, the limb preserved its natural uprightness, and was capable of being rotated outwards. When an attempt was made to elongate the limb, the great trochanter descended together with the whole upper extremity of the thigh, a sort of crepitus being, at the same time, frequently audible, resulting from the rubbing on each other of contiguous hard and smooth surfaces. These phenomena were alike observable on both sides.

The facility with which the limbs could be elongated suggested to us the idea of maintaining such an amount of gentle tension, as to keep the head of either femur on a level with the acetabula: a belt affixed to the hips was employed to press downwards the upper ends of the thigh-bones, whilst traction was employed on the feet for the same purpose, at the same time that the trunk was made fast at its upper part to the bed: in standing or walking the body was always supported on crutches. A certain amount of success encouraged us to persevere in the employment of these measures for a considerable period; but, as our anticipations were not fully realized and the patient was very intractable, the treatment was ultimately abandoned. Nevertheless, I may truly say that this young lady had very much improved in her walking when she quitted our establishment. It is probable that this amendment was in part due to the cold salt water and sulphurous baths which were employed, as well as to the tonic influence of the douche which was locally administered, and the gymnastic exercises which she was passionately fond of; but this happy result I am disposed especially to attribute to the agency of the extension which has been described.

---

[1] [This case appears to have been inserted by the editors; who also refer, in a note, to a dissertation by M. Caillard Billonnière, 'Sur les luxations originelles ou congénitales des Fémurs,' Paris, 1828, No. 233. This gentleman, it appears, dissected one of these cases under the direction of M. Dupuytren, and deposited the specimen in the museum of La Pitié. The editors also refer to Paletta's 'Adversaria chirurgica' for some account of this affection, stating that this memoir was wholly unknown in France at the time that Dupuytren was making his researches.—Tr.]

CHAPTER XI.

FRACTURES OF THE NECK OF THE FEMUR, THEIR CAUSES AND TREATMENT.

If an inquiry were instituted respecting the age of the different individuals under treatment in the Hôtel-Dieu, at the time I am now writing, for fractures of the cervix femoris, it would be found that they are, with few exceptions, above fifty years of age; and amongst the cases I shall have occasion to narrate in the course of the present chapter, it will be perceived that there are no children and but very few adults. Moreover, the reader will remark that in both sexes these fractures are relatively more frequent after the age of sixty. In contemplating the differences between predisposing and exciting causes generally, the distinction is very striking in these cases. I have never seen a fracture of the neck of the femur in a child; and they are extremely rare in young people generally. Sabatier, indeed, cites, in his interesting Memoir included amongst those of the ancient Royal Academy of Medicine, the case of a boy of fifteen, who was the subject of this injury: but these lesions become relatively more numerous as life advances, the number being very suddenly augmented towards fifty or sixty years of age; and instances of the accident are still more frequent at seventy or eighty.

It is absurd to suppose that there is not some specific cause to account for this difference in the frequency of fracture of the cervix femoris at various periods of life: indeed, it is positively ascertained that this cause resides in the anatomical arrangement of the parts, which presents a marked contrast at divers ages in both sexes; and in certain accidental circumstances, either of a transient or permanent nature.

The neck of the femur changes its direction at different ages; and this point alone is of great importance. In early youth, the axis of the neck is nearly in a line with that of the shaft of the femur, the angle which is formed at the union of these two parts being extremely obtuse. The jutting of the great trochanter is, moreover, very trifling; and I shall, by and by, point out that falls on this process are the most usual cause of fracture of the cervix femoris, and that the frequency of this lesion holds a direct relation to the prominence of the great trochanter: further, the prominence of this apophysis is likewise directly proportioned to the length of the neck of the femur, and the angle it forms with the shaft of the bone. Thus, we know that the great trochanter is very little prominent in young children, and that, so to speak, it lies hidden beneath the elevation of the ilium: the consequence is that in falls upon the side, the shock is not received upon it (the trochanter), and the probability of the occurrence of fracture is thus diminished.

Another point in the anatomical disposition of the parts is a further obstacle to fractures of the neck of the femur. The shorter this portion of the bone is, the more obtuse is the angle formed between it and the shaft, and consequently the nearer it approaches to the axis of the femur: thus, the causes operating to produce fracture have less influence on the neck of the bone; and the force which tends to rupture its component fibres, whether propagated from below upwards or from above downwards, as in a fall on the feet, knees, or great trochanter, acts scarcely at all upon it. In fact, the violence of these shocks is concentrated in the head of the bone and not in the neck, as the latter is scarcely at all developed.

There is still a third reason why these fractures are rare in the young, which is the great flexibility of the osseous tissue, consequent on the relative abundance of organic matter in the bones at this age. This may be proved by suspending a weight from the extremity of a child's thigh-bone, which will bend under it; whereas the femur of an old person will first bend and then break. Lastly, if we add to the above causes the small size of the pelvis in childhood, and the abundance of adipose tissue in the neighbourhood, which forms a sort of cushion to protect the great trochanter, sufficient has been shown to prove how almost impossible fracture of the cervix femoris is, in children and young persons of either sex.

Even in adults this lesion is of rare occurrence, though less so than in children. At maturity, the neck of the femur presents an arrangement altogether different: it is in the first place much longer, and the angle which it forms with the shaft is much more decided than in childhood: the consequence is that the trochanter major is more prominent, and is thus brought more under the influence of causes tending to produce fracture of the neck, whether the force be engendered below or above. Nevertheless, both the length of the cervix femoris and projection of the trochanter vary in the two sexes, and even in individuals. In women the neck of the femur is longer, and the trochanter consequently more prominent than in men: we might therefore anticipate, what is really the case, that the lesion under consideration would be more frequent in females: and the volume and relief of the muscles which tend in the adult male to modify the shock of falls, also constitute in him a further obstacle to fracture; whereas, this injury is of more common occurrence in those men whose form is more assimilated to that of women, in the breadth of the pelvis, the length of the cervix femoris, and prominence of the great trochanter. It is true that the thick cushion of fat which invests these parts in women, in great measure fulfils the same office in this respect, as the muscles do in men; yet when both are equally thin, it follows, from the anatomical reasons already assigned, that women would be more subject to fracture of the neck of the thigh-bone than men.

Let us now inquire why old people should be so obnoxious to this injury. At an advanced period of life the pelvis has acquired its full development, the great trochanter is prominent, the neck of the femur is longer, and inclined so as to form nearly a right angle with the shaft of the bone: further, the skeleton in the aged weighs much less than in the adult, which circumstance is dependent on the decreased proportion of the organic elements in the bones, and their generally diminished volume. The absence of adipose matter and the flaccid state of the muscles about the hip, together with the general leanness which is usual at this age, are further reasons why fracture of the cervix femoris should be more frequent in the old.

There is considerable difference of opinion amongst authors respecting the changes which the bones undergo in old age. Some, with Bichat at their head, affirm that their earthy portion is constantly increasing in quantity, whilst others, on the contrary, maintain that they become remarkably porous.

M. Mercier has established as a fact, that the compact tissue in the middle of the long bones is more dense and difficult to rupture in the old than in the adult. The calibre of the medullary canal is certainly augmented; this difference, however, is due to the almost entire disappearance of the cancellated structure. But if the extremities of the above class of bones are examined, they are found to have lost in substance by a process of absorption: at these points the areolar spaces of the spongy texture are observed to increase in size as the medullary canal is approached. This porosity of the extremities of the bones in old people has more influence in rendering them fragile, than the defective elasticity in the shaft, which is compensated for by the proportionate increase of hardness; and may, therefore, be regarded as one of the causes why fracture of the cervix femoris is so common at an advanced period of life.

I will now endeavour to point out why old women are more subject to this lesion than old men. If the arrangement of the parts concerned be submitted to careful examination in the former, it will be remarked that the neck of the thigh-bone is longer, and its obliquity in relation to the shaft of the bone less considerable; that the great trochanter is more prominent, and the friability of the osseous tissue more decided than in the latter. Females at an advanced age are also frequently very thin: hence we find that all these anatomical peculiarities, which may be viewed as so many predisposing causes of this fracture, are even more strongly marked in women than in men. That the fact is so may be readily verified by an appeal to the civil hospitals, especially those appropriated to the reception of the old of both sexes: in the Salpêtrière, for example, out of a given number of individuals, the total of the cases of fractured cervix femoris considerably exceeds that which a similar calculation affords in the Bicêtre, an asylum for aged men. Important applications to the theory of fractures generally spring from these considerations: thus, in childhood a cure may be effected in three weeks or a month, whereas in the adult a much longer period is required; but in old age especially, the greatest care and attention are called for: one hundred, one hundred and twenty days, or even a longer period, may be found essential for the completion of the process of consolidation.

The infrequency of fracture of the cervix femoris in the earlier periods of life has not been overlooked by Sir Astley Cooper, who states that this accident rarely occurs before the age of fifty:[1] but there are exceptions to this rule. Independently of the general, there are certain special, causes which predispose to this injury, such as the friability of the osseous tissue arising from rickets and cancerous affections: but as the effects alluded to equally affect all parts of the skeleton, I shall not here dwell upon them.

We now come to notice the efficient or exciting causes of this fracture. Nearly all the patients whom we interrogate on this subject reply, that the shock was received on the great trochanter, and that they fell on their side, without having the time or power to extend the arm to save themselves. The frequency of this cause all authors agree in admitting. Thus, in thirty-six cases which Desault witnessed in a given period, twenty-four were produced in this way. In children and young persons who have had a similar fall, but who have been saved by the anatomical peculiarities already noticed from fracture of the neck, we sometimes find separation of the epiphysis. The above is not, however, the only way in which fracture of the cervix is produced: but before proceeding to notice the other causes of this accident, I must make a remark which has very little attracted the attention of observers, viz. that a contusion of the soft parts accompanies the injury of the bone. I very recently examined a woman from whom I could get no satisfactory reply to my questions: on touching the great trochanter she evinced considerable pain, though I did not move the limb: then on examining this region I found a large ecchymosis, which no longer left any doubt of the contusion. This circumstance, which is also observable in fracture of the neck of the humerus, is important in leading to the detection of the part on which the patients have fallen, when they are themselves unable to give an account of the accident, or are in any way disposed to mislead the surgeon.

I have remarked that there are causes productive of the lesion under consideration, besides a fall on the trochanter: such, for instance, are falls on the soles of the feet when the legs are extended, or on the knees: but, in either case, the muscles must be in action so as to render the limbs inflexible, otherwise the shock of the fall is broken. Sir A. Cooper has observed that, in London, fracture of the cervix femoris is very frequently produced by slipping off the kerb-stone. Be the cause what it may, the head of the bone is forced against the acetabulum in a way which tends to increase the acuteness of the angle formed between the neck and shaft of the femur: thus, in a fall on the feet, the effect is that of a force operating on the two extremities of a bent lever; and when fracture of the neck of the femur is the result, it is the upper fibres which first give way. I have several times observed, as I shall describe anon, that the acetabulum had been forced in by the pressure of the head of the bone, after a fall on the feet or knees.

---

[1] Essays by Cooper and Travers, vol. i, p. 145.

The last mentioned is not, however, the usual mode in which this fracture is produced; a fall on the hip is the cause which determines the injury in a large proportion of instances. In this case the neck of the bone is placed between two opposing forces; and when it is borne in mind that this part is situated obliquely in relation to the shaft, and forms a salient angle with the great trochanter, it is easy to conceive how the solution of continuity is effected. The various circumstances tending to this result may be thus stated: when an individual falls on the hip, on the one hand the head of the femur is pressed by the weight of the body, and on the other the great trochanter sustains the direct shock of the fall; the neck being between these two points, is thus acted on in a way which tends to straighten it or reduce its obliquity; in other words to bring its axis into the same direction as that of the shaft; and thus the fracture is produced. Sometimes the head itself is in this way broken, at others the fracture may take place through the great trochanter or through the neck near to it, or again below the trochanter through the upper extremity of the shaft of the femur; but most frequently the seat of fracture is immediàtely below the head, at the upper and inner part of the neck. But are there not still other causes productive of this lesion? no doubt there are, and muscular action may be enumerated as one of them. Thus, the case of a young negro is mentioned in which fracture of the cervix femoris was consequent on the muscular spasm of tetanus. In these instances, the force productive of the mischief operates in the same way as in falls on the soles of the feet or on the knees. But such cases are evidently associated more or less with a scrofulous, rickety, or cancerous diathesis, of which I regard the following as a fair illustration.

Case I. *Fracture of the neck of the right femur in a cancerous subject. Non-union, death, and autopsy.*—M. Collin aged 54, of a sanguineo-bilious temperament, but well-formed, was admitted into the Hôtel-Dieu with fracture of the neck of the right femur, which had happened on the previous evening, She had in her right breast a large open cancer, which had existed for several years, and discharged a copious fetid and sanious pus; but I was not made aware of this fact at the time. for she had sensitively concealed her disease from those around her. It was, doubtless, in consequence of the system being impregnated with this poison that the cervix femoris was broken by the simple act of getting into bed. She suffered acute pain at the moment the accident occurred, and was unable to move the limb without this suffering being increased. When brought to the hospital on the succeeding day, there was considerable shortening of the limb, the position of the heel being behind the inner malleolus of the opposite foot, between it and the tendo achillis; the whole limb was rotated outwards: the great trochanter was less prominent than naturally, being approximated to the crest of the ilium, and turning as if on a pivot: the limb could not be raised altogether, and great pain was experienced in the hip-joint.

The cause of this fracture appearing extraordinary, I questioned the patient regarding her general health, but she persisted in obstinately concealing the disease of her breast. The fractured limb was placed on a double-inclined plane, and the patient expressed herself as relieved by this position.

In the course of a week, the anguish she endured in her breast became so intense, that the attendants forced her to divulge her secret; and thus the real cause of the fragility of the femur became apparent. It was too late, however, to attempt any efficient means of curing her disease, as the neighbouring axillary ganglia were involved, and the whole system was evidently tainted: a palliative course of treatment was, therefore, adopted, and the wound dressed with cerate containing opium, and emollient poultices; anodynes were also administered. The double-inclined plane was re-arranged whenever it got out of order.

At the end of seventy-five days there was not the slightest evidence of any union of the fracture. About the same time the disease in the breast advanced rapidly, and she ultimately sank under the discharge and attendant constitutional disturbance, after she had been in the hospital fourteen weeks.

Autopsy.—There was no trace of union at the seat of the fracture, which was found to extend through the centre of the neck. There was pleuritis on the right side with effusion; and cancerous tubercles were present in the liver and lungs: there were also patches of ulceration in the intestines.

Fracture of this part of the bone may also result from a force operating directly upon it; such, for instance, as wounds produced by fire-arms, especially when charged with ball. I had the opportunity of witnessing some cases of this sort in the recent revolution, both at Paris and St. Cloud. When fracture is thus produced, the ball rarely makes its exit, on account of the resistance it meets with in its progress; but remains buried in the soft parts. Further, these cases are usually complicated by the bone being shattered; and as it is very troublesome to remove the splinters, union takes place with difficulty, and death is almost always the result of this accident. Thus, one aperture, and sometimes two, communicating with the fracture, the presence of foreign bodies, a comminuted state of the bone with loose fragments, an abundant suppuration and the formation of abscesses, together with symptoms of re-absorption; and lastly, the rare sequel of union of the fracture,—may be enumerated as constituting the distinctive characteristics of this injury, when produced by violence directly applied to the seat of lesion.

Case II. *Fracture of the neck of the femur, produced by gunshot wound: death, and autopsy.*—Martin Firer, aged 22, a printer, was struck in the left groin by a ball, on July 28th, 1830: he fell, and was unable to rise again; but was immediately carried to the Hôtel-Dieu. The ball had completely penetrated the limb, one aperture being at the fold of the left groin, eight or ten lines internal to and beneath the anterior superior spine of the ilium, and the other (the point of exit) two inches behind the great trochanter. The slightest movement of the limb was attended by excessive pain. The wounds were dilated, and the patient was freely blooded. On the fourth day his general condition was satisfactory: the pulse was quiet, and he only complained of a local pain, which was supportable whilst he was in a state of repose, but very severe when the limb was moved: he therefore remained at perfect rest on his back. The suppuration was at first very moderate, and even diminished in quantity: but on the 14th of August (the eighteenth day) he began to complain of more severe pain along the thigh to the knee, and motion of the limb caused more and more suffering. Fifteen leeches were applied behind and beneath the great trochanter, and the parts were fomented and poulticed; but without much relief. Two days afterwards these remedies were repeated, but still without mitigation of the symptoms: suppuration had almost ceased, and was replaced by a serous oozing from the wound in the groin. A further application of leeches was still unattended with benefit; and on the twenty-sixth day the pain became more concentrated in the iliac fossa, in the groin, and around the great trochanter. The articulation was then covered with leeches; but, on the following day, the patient was attacked with acute rheumatism in the various joints of the upper extremity, which, in spite of very active treatment, terminated fatally on the 29th of August.

Autopsy.—The ilio-femoral articulation being freely laid open, the neck of the femur was found broken, with several fragments of bone in the neighbourhood bathed in pus: the capsule was almost entirely destroyed. The wrist-joints were filled with pus; but there was no evidence of disease elsewhere.

Case III. *Fracture of the neck of the femur, from a gun-shot wound: death, and autopsy.*—Nicolas Chevain, a lancer in the royal guard, was struck on the hip by a ball, on the 28th July, 1830, just as he had dismounted from his horse: he was not brought to the Hôtel-Dieu until the following day. There was but one wound, which was situated between the great trochanter and crest of the ilium; but it was ascertained that the direction which the ball had taken was towards the neck of the femur. He was unable to move the limb himself, and suffered very acutely when any attempt at passive motion was made. The wound was dilated, and the limb placed on a double-inclined plane. The suppuration which ensued was moderate; but the pulse was sharp and quick, and the cheeks were flushed. Each evening there was a feverish exacerbation, succeeded by sweating, for which blood was taken from the arm; and twenty leeches were likewise applied around the articulation. By the adoption of these measures the febrile symptoms were, for a time, kept at bay; but, in the course of a few days, they returned with increased intensity, accompanied by dyspnœa, pain in the right hypochondrium, and a jaundiced tinge over the whole body, but especially in the face. The region of the liver was freely leeched, but without any relief, and the patient sank into a state of exhaustion and died.

Autopsy.—The course which the ball had taken was towards the upper part of the neck of the femur, traversing a space of nearly four inches in extent. The cervix itself had suffered a comminuted fracture, and the ball was lodged in one of the fragments: a few splinters only were found imbedded in the soft parts above and behind the joint. The form of the ball was but little altered: there was pus in the interior of the joint, and the interarticular and capsular ligaments were altered and in part destroyed. The right pleura was inflamed, and its cavity contained serum and organized lymph. The lungs themselves and the abdominal viscera were healthy, the liver alone being large and gorged with blood, and the intestinal canal a little injected at parts.

In reviewing the causes productive of fracture of the cervix femoris, they may be arranged in the following order of frequency: first of all, falls on the great trochanter; secondly, causes acting directly on the seat of injury; thirdly, falls on the knees or soles of the feet; and, lastly, muscular action, if the existence of authentic cases of this class be admitted.

The diagnosis of fractures of the cervix femoris is not unattended by considerable difficulties; and more than once I have known experienced practitioners puzzled as to the opinion they should give. Thus, we sometimes meet with instances, in which there are signs seeming to indicate the existence of fracture, where it is not present; and others again, in which none of the characteristic signs are present, although there really is fracture. It sometimes occurs that a severe contusion of the muscles and joint may resemble in its features this fracture; whereas, the same cause, producing fracture, may nevertheless permit the patient to get up and walk. Thus, individuals who have had the neck of the femur broken, have been known to reach their homes without the appearance of any shortening of the limb; and displacement of the fragments may not take place for hours or days, or even as much as a month, and is then the result of some movement of the patient, or of the examination of the surgeon.

The impracticability of raising the entire limb, has been enumerated amongst the constant signs of fracture of the cervix femoris. But the exactness with which the fragments lock into each other, and the resistance of the fibrous tissue which surrounds the neck, sometimes permit the patient to perform this movement. A case fell under my observation recently, in which the patient died of fever; and on examining the ilio-femoral articulation, a fracture was found through the neck of the femur within the joint; and the fragments, being irregular, remained in their proper relation to each other, and were retained in contact by a fold of the capsular ligament. But what is the cause of this peculiarity which authors have noticed, which I myself have observed, and of which Sabatier has related instances in a memoir which he communicated to the Academy of Surgery? I apprehend that it depends upon the seat of fracture being within the capsule, so that the fragments remain in position, and are fitted into each other, the lower resting against the upper. Yet, it may be again asked, why is this relation lost after a longer or shorter time, so that the fracture becomes palpable? The change in question appears to be dependent on the influence which the weight of the body or muscular action exerts, on the absorption of some portion of the fragments, or on the laceration of the fibrous capsule, which may be either primitive or consecutive. The shortening and altered position of the limb leave no doubt about the existence of fracture, if the only cause of the injury which can be ascertained is a fall that happened some days previously. The two above-mentioned signs sometimes do not make their appearance until after the lapse of fifty, sixty, or even eighty days of treatment by rest and extension, which circumstance is probably attributable to the callus having yielded to muscular contraction or the weight of the body.

One remarkable phenomenon which is occasionally observed, is lengthening of the fractured limb. This form of displacement is extremely rare, and the only instance of it that I am acquainted with is that noticed by M. Lisfranc: it probably depends on the obliquity of the fracture, and on the edges of the fragments resting against each other.

M. Lallemant, whose modesty equals his erudition, mentions another cause of lengthening, noticed by him in an old woman at the Salpêtrière, viz. a paralytic state of the muscles of the injured limb. It is not difficult to conceive that this negative cause would be an efficient one in the erect position, as the weight of the limb would have its full influence in producing the effect, unopposed by the action of the muscles.

I have remarked that laceration of the capsule may be either primary or consecutive. The first effect takes place, when the cause which determines the fracture produces at the same moment displacement of the fragments. The second is observed when the relative position of the fractured extremities is not disturbed for some days; or when such displacement having been originally produced without injury at the time to the capsule, the latter is torn by the subsequent movements of the patient. But this form of consecutive displacement is not the only one: there is yet another to which the attention of surgeons has been very little directed.

It is well known that, at the early period of its formation, the callus in the shafts of long bones often yields, and that deformities, in fractures which had been carefully superintended, are thereby produced, at a period when there might be a reasonable expectation of a perfect and regular union of the broken bone. Who has not witnessed cases of oblique fracture through the shaft of the femur, in which it is very difficult to maintain the exact adjustment of the fragments, and where the callus has yielded to the superincumbent weight of the body, producing deformity, in consequence of the patient attempting to walk at a period when all fear of such a result had ceased to exist? This is exactly what occurs in many fractures of the neck of the femur, in which there had been little or no displacement in the first instance.

The provisional callus yields, after the lapse of two or three months, to the weight of the body; and the fragments ceasing to be in juxta-position, the limb becomes deformed and shortened. I have seen instances in which this result has occurred two, three, or four months, or even longer, after the receipt of the injury. An acquaintance with these facts teaches us an important lesson, and will serve to impress on the attention of my readers what I have already adverted to, viz. the necessity of protracting the treatment of fractured neck of the thigh-bone to one hundred, one hundred and forty days, or even longer, for the purpose of allowing the callus sufficient time to acquire the requisite solidity.

The weight of the limb, but especially that of the body on the broken bone, may be regarded as one important cause of displacement, whether primitive or consecutive, in consequence of the tendency which it produces to force the upper fragment downwards and the lower upwards. But another agent by which this effect is produced consists in the prolonged operation of the cause which occasioned the accident; and this cause operates in a remarkable manner: when it is carried very far, it sometimes happens that the upper fragment is thereby imbedded in the spongy texture of the superior extremity of the lower fragment, and union is effected pretty quickly in this position; but there is permanent shortening of the limb and deformity, the deviation corresponding in direction to that in which the one fragment was originally forced into the other. In such cases, the displacement may be either backwards or forwards; and the amount of shortening does not exceed that of the depth to which the neck of the bone is buried in the spongy texture of the lower fragment. There are several pathological preparations in the museum of the Hôtel-Dieu, which exhibit the fractured extremities thus united, and are convincing evidence of the reality of this interesting fact. It is useful to be acquainted with this cause of deviation of the limb; as it may account for those comparatively rare cases in which the foot is inverted in fractured cervix femoris: such instances have been noticed by Ambroise Paré, J. L. Petit, Desault, and others.

Lastly, there is another cause of displacement of the fragments in fractured neck of the femur, which is in constant operation, and to counteract the influence of which the surgeon is always exerting himself, in order that he may obviate the tendency to vicious union and deformity; I allude to muscular action, which I shall speak of more at large when the treatment of these injuries is under consideration. What I have already had occasion to remark is sufficient to show that displacement takes place much more readily before the formation of the callus; and this consideration is a further reason for adopting the division of the symptoms attending fracture of the neck of the femur into primary and consecutive, accordingly as the shortening is observed before or after the deposition of callus.

The primary symptoms occur when, in falling on the heel or knee, the shortening and deviation manifest themselves at the moment of the accident; in which case it is evident that the upper fragment retains its position, whilst the lower is forced upwards by the weight of the body. But a vertical fall is comparatively rarely the cause of fracture of the cervix femoris, and the effect is quite otherwise determined when the patient has fallen on the great trochanter, which is much more frequently the cause of this lesion: the direct tendency of the force would be in such case rather to lengthen than to shorten the limb: we must therefore seek for some other cause for the shortening which is equally observed in these cases, and which has, in my opinion, been hitherto but little understood or wrongly accounted for. It has been usual to attribute this effect to the action of the glutei muscles; but, by the rotation of the limb outwards, these muscles are relaxed; the change in question, therefore, cannot be due to their action. The gemelli and quadratus have also been considered as likely to favour this displacement; but they can have no more influence than the glutei, as the eversion of the thigh likewise relaxes them; and when the limb is placed on an inclined plane, the deviation in question ceases, although the glutei are put on the stretch.[1] But there are other muscles which spring from the pelvis and are inserted into the thigh; these are the adductors, which, having for their function (in part) to rotate the thigh outwards, take their origin from the rami of the ischium and pubes, and terminate in the linea aspera of the femur: to the action of these the altered position of the limb is, at least partly, attributable. This sign exhibits itself when the patient makes an effort to raise himself, or else it results from a slow, tonic contraction of the muscles, which are no longer resisted as when the bone is in a state of integrity. Muscular action and the superincumbent weight co-operate in producing shortening after the callus has been deposited, by the patient exercising the limb or walking prematurely.

I will now pass on to an enumeration and analysis of the various signs of this injury; and this examination will furnish us with important matter for consideration. When there is displacement, the fracture is always readily detected; but when this is not the case, it may be suspected, although its existence cannot be positively asserted. Even supposing the ordinary signs to be well marked, it is still necessary to ascertain whether the limb can be extended to its natural length, and whether the great trochanter moves, in rotation, on the axis of the femur, or on the extremity of the lever (the head of the bone). If the shortening does not exceed many lines, it is difficult to distinguish it from the effect produced by a tilting of the pelvis, consequent on contusion; but when it amounts to one, two, or three inches, it becomes very evident. This degree of shortening, however, rarely exists at first, but is produced consecutively by the patient walking too much: yet, how many sources of error have we to combat in these cases! Thus, for instance, patients will frequently attribute an old shortening to a recent fall, in the hope that some fresh attempt will be made to cure them of the deformity: but a careful examination and adroit questioning generally suffice to expose the deception. Where, however, the displacement is recent, it should be borne in mind that it may depend on dislocation of the head of the femur, or on a tilting upwards of the pelvis: therefore, great caution is requisite to avoid being misled by this sign alone.

---

[1] [This reasoning is scarcely conclusive, as the rotation outwards of the thigh is *partly* produced by these muscles, which at the same time *assist* in drawing upwards the shaft of the bone.—Tr.]

In dislocation upwards and forwards, the head of the femur rests on the horizontal ramus of the pubes, raising or separating the vessels and nerves: in this case there is shortening, but at the same time there is a hard tumour in the groin, which rolls under the finger when the femur is moved. In dislocation into the foramen ovale, the limb is everted; but then it is likewise lengthened, and there is an abnormal fulness and resistance opposite to the thyroid hole, together with unusual tension of the muscles; the hip also is hollow, whereas it is prominent in fracture. In dislocation upwards and backwards, the head of the femur is in the external iliac fossa, and the limb is shortened; but in this form of injury the whole extremity is inverted.

It is true that, in cases of fracture, inversion of the limb has been occasionally observed. Ambroise Paré, who was the first to speak of this affection, narrates an instance in which he was called to a lady who had had an accident, and that he found the injured limb shortened, and the great trochanter drawn up on the ilium: he thought the femur was dislocated, and after making extension, he applied an appropriate apparatus. But in the course of a few days severe pain supervened, and he found the limb again shortened, and the foot inverted. J. L. Petit cites a similar instance in his 'Traité des Maladies des Os.' I cannot, however, say that I have met with more than one or two cases at most of this sort in the course of my practice: therefore I am disposed to think that Bichat was deceived in supposing that this peculiar position of the limb was very common. Nevertheless, as inversion of the thigh has been occasionally observed in fracture of the neck, it becomes necessary to point out the distinguishing characteristics between this injury, under these circumstances, and dislocation upwards and outwards. In the latter form of injury, the rounded head of the femur is felt in the external iliac fossa: in the former, the limb may be easily rotated; but in dislocation this is altogether impracticable. Again, the limb cannot be extended to its natural length when dislocated, without the employment of great force and completing the reduction; and when once reduced, the deformity does not reappear: whereas in fracture, a comparatively trifling effort is sufficient to restore the limb to its natural length; but it is again shortened as soon as the extending force is removed. It is, therefore, impossible to mistake either of these accidents for the other. Lastly, there is a dislocation downwards and backwards, of which I have seen only two or three examples, and in which the limb is inverted and lengthened; but here the same diagnostic test may be employed as in the last-mentioned instance, and it is equally conclusive.

An error into which many have fallen, and which I have already had occasion to point out, arises from the following circumstance. If the patient is suffering from pain in the hip resulting from prior disease, that side of the pelvis is drawn up, and an appearance of shortening is the consequence. This effect may be produced in the erect posture, and is a method of deception not unfrequently employed by conscripts. If one hip is elevated, the heel necessarily follows it, and is raised from the ground; and by walking on the point of the foot, the effect resembles an accidental dislocation.

Sometimes, however, violent contusion of the joint will cause the patient to relieve himself by the same means, without his having any intention of dissembling. In such case, all that it is necessary to do for the detection of the fallacy is, to place the patient on some hard horizontal plane, a table for instance, and lay a rule or tape across the pelvis, from one anterior superior iliac spine to the other; and the difference in their relative elevation will be found to correspond exactly with the degree of shortening of the limb, provided such abridgment depends only on the tilting of the pelvis: in such case also there is no difficulty in restoring the normal condition of parts, by drawing down the elevated hip, so as to place it on a level with the opposite; and then the deformity disappears.

I have remarked that the limb is ordinarily everted in fracture of the cervix femoris. Now, if the ordinary position of the feet be noticed in a person lying on his back, it will be found that there is an interval of about eight or ten inches between them: but this is not the case where there is fracture; and the foot of the injured limb rests on its outer border, the point touching the ground: the patella is also turned outwards, but not quite to the same extent; and the heel is directed towards the malleolus of the opposite foot, and the ham towards the opposite knee. The instances in which the limb is inverted are so rare, that they do not average, probably, more than one in a hundred: where such is the case, the position of the various parts enumerated above is, of course, reversed.

Having already pointed out that the action of the adductor muscles satisfactorily explains the external rotation of the limb in fractured cervix, I ought to mention that the obliquity of the fracture may account for inversion of the thigh when it occurs. Let us suppose, for instance, that the shaft of the femur is fractured obliquely from below upwards; in such case the upper fragment will be carried forwards, and the lower backwards: but when the obliquity of the fracture takes an opposite direction, the reverse is the case. So, likewise, in broken neck of the femur, the fracture may, by its obliquity, allow of the inner fragment passing backwards, and the outer forwards; then there would be rotation outwards: but, if the inner fragment be driven forwards, there would be inversion of the limb. The oblique direction of the fracture may, therefore, very well explain, in some cases, the deviation of the foot, whether inwards or outwards. M. Mercier, whose opinion I have already frequently quoted, thinks that the rotation in question is attributable to the position in which the limb is laid when the patient is placed in bed, and perhaps also to the direction of the fall; for it may happen that the force is applied rather behind than in front, in which case the great trochanter would be forced forwards.

After having spoken of the signs, it seems a natural transition to pass on to the consideration of the consequences, of these fractures when left to themselves, that I may thereby render more intelligible the rationale of the treatment to be adopted. I have very frequently seen patients, who have fractured the neck of the thigh-bone without having submitted to treatment, present a shortening of two, three, or four inches, with eversion of the limb, which, together, rendered progression difficult: the great trochanter is, in such cases, elevated and carried backwards, resting near the crest of the ilium. But a fact which it is most important to be acquainted with is that, under these circumstances, there is a false joint formed in the external iliac fossa.

I will now review in succession the various positive effects of these fractures, commencing with the acetabulum. I have three or four times seen this cavity driven in by the head of the femur; and the accident was produced by a fall on the feet or knees. The explanation of this result seems to be, that the force is so applied as to act directly on the cotyloid cavity; and that, offering less resistance than the head and neck of the femur, it consequently yields. The most remarkable instance of this nature which has come under my observation, is one in which the acetabulum had entirely given way, whilst the head of the femur passed, uninjured, through the opening, so as to lie completely within the pelvis: the neck, which was also unfractured, was so tightly locked in the artificial opening, as to render its disengagement extremely difficult in the dissected preparation. In the earlier periods of life, a similar cause may operate so as to produce disintegration of the component portions of the os inominatum, which, it will be recollected, are united to the acetabulum: Ludwig narrates a case of this sort.

Another class of cases is met with, in which the acetabulum is fractured, without the head of the femur being displaced: but, most frequently, the effects of the fracture are felt at the upper extremity of this bone. One of these effects is a radiating or comminuted fracture of the head of the femur, the neck remaining wholly uninjured; and this is not very uncommon where the fall has been on the great trochanter, or on the soles of the feet: but it is more frequently the result of force directly applied, as in gun-shot wounds. In cases of this sort, where there is fracture of the head, without injury to the neck, of the bone, the fragments may retain their relative position, and there is consequently no shortening nor other deformity of the limb. It is scarcely matter of surprise that such a fracture should be mistaken for severe contusion of the joint, and treated as such, which is most usually the case: the subjects of the injury may get well without deformity; and it is only when death occurs from some circumstance, either associated with, or foreign to, the accident, that the nature of the lesion is ascertained.

The cervix femoris is much more frequently the seat of fracture because it forms a bent lever; and its comparative slenderness towards the centre is equally favorable to a solution of continuity. Fracture may occur at different parts of the neck; sometimes it is immediately below the head, just at the limit of the articular cartilage: but it is more frequently lower down, i. e. where the neck has least substance, about its centre. Again, the direction of this fracture may extend from below upwards or from above downwards; or the anterior or posterior part of the bone may be the first to give way: but this depends on the character of the fall and the inclination of the body in falling. The most usual seat of fracture, however, is at the base of the neck, in consequence of the accident being almost always the result of a fall on the great trochanter, which is itself sometimes broken, and in some instances completely separated from the shaft of the bone by the force of the fall, as I have occasionally witnessed. When the great trochanter resists this force, the fracture is most commonly observed to take a direction from that process towards the smaller trochanter; which makes it appear as if the injury belonged rather to the upper part of the body than to the neck of the femur: in other instances, the fracture extends from the small to the great trochanter, or else from the latter to the neck.

In respect of the direction which the fracture may take, there exists such an infinite variety, and there are so many shades of difference, that the most minute description would scarcely suffice to include them all. When it is perpendicular to the axis of the neck, the fractured extremities rarely correspond; for they cannot rest against each other, as their plane or nearly smooth surfaces are continually gliding, the one over the other: again, if the fracture is oblique in relation to the axis of the neck, the same tendency exists; but in these cases there are certain distinctions to be drawn. In short, the obliquity is either from within outwards, or from below upwards. In the latter case, there is no obstacle to prevent the external fragment from ascending, and consequently the displacement in this direction very readily takes place: but in the former this is not so; the outer fragment meets with the resistance offered by the upper or inner fragment, and the displacement is less constant. But, as there is no method by which we can ascertain what really is the direction of the fracture, the proper course to pursue is, to treat the case as if the obliquity were such as would most tend to favour displacement.

I now come to a point of considerable interest in reference to the position of these fractures, which is, their division into those which are *intra-capsular*, and those which are *extra-capsular*. It is a distinction on which much stress has been laid, and with reason; for many surgeons are of opinion that it is very difficult, and even impossible, for union of the fracture to take place where the injury is internal to the capsule, whereas, they admit the possibility, and even facility of such union when the fracture is external to the capsule.

Astley Cooper, whose authority is so imposing in surgery, explicitly states that, in all the cases of transverse fracture of the neck of the femur which he has had the opportunity of examining, he has never seen one in which there was union by bone. "The dissections which I have made," adds this illustrious surgeon, "have convinced me that fracture of the neck of the femur, when it is situated within the capsule, is never united by bone; the union is solely effected by means of a ligamentous substance, as in fracture of the patella." This celebrated surgeon has since modified his opinion, as we find him remarking that, as a general rule, fracture of the neck of the femur within the capsule is united by ligament and not by bone, as in the cases of the olecranon and patella; but that it would be a rash assertion to deny the possibility of ossific union, and to maintain that the general rule laid down admits of no exception.[1]

Under the impression that osseous union of fractured cervix femoris was impossible, Astley Cooper performed some experiments on living animals which confirmed him in this conviction; and English surgeons generally have adopted the opinion of their celebrated countryman. But if it is on facts that this conclusion is founded, I have it in my power to advance other and very numerous facts of a contrary tendency. Several anatomical preparations of intra-capsular fracture of the cervix femoris, well united, are to be seen scattered through the different museums of anatomy. Those which the shelves of the faculty of Paris and of the Hôtel-Dieu contain, prove the reality of bony union, with or without deformity, beyond question. The ossific deposit in these specimens is often very regular, presenting itself sometimes in the form of connecting bridges, extending splint-wise from one fragment to the other. It seems probable that Sir Astley Cooper had only seen fractures of the neck of the femur which had not been cured, or which had been badly treated or altogether neglected. I know of no other means of explaining the opinion of the English surgeon, which appears to me so palpably erroneous.

---

[1] [On this controverted point the reader will satisfy himself by reference to Sir Astley Cooper's work. I would only remark, in reference to the above comment, that no modification of opinion seems to be implied in the latter extract, further than that which may be gathered from the English surgeon's avowal, that he was then (as he must ever have been) open to conviction.—Tr.]

I must, however, admit, that an examination of the preparations alluded to, and which so convincingly prove the reality of bony union in cases of *intra-capsular* fracture, does not seem to have satisfied other English surgeons who have visited the museum of our faculty. After a careful consideration of the specimens preserved in the Ecole de Médecine of Paris, Mr. Cross remarks, "none of these specimens, therefore, proved to me, that bony union ever follows the fracture of the neck where the head of the bone becomes isolated, except at its attachment to the pelvis by the ligamentum teres."[1] I can only say, for my part, that if the specimens at the Hôtel-Dieu are insufficient to satisfy any one who may take the trouble to examine them, I am at a loss to know what amount of evidence such sceptics would require. For my part, I regard the osseous union of intra-capsular fracture of the neck of the thigh-bone as demonstrated, and placed beyond doubt.

As many practical and theoretical reasons have been adduced for and against this union, I shall briefly state them. It has been asserted, in the first place, that the upper fragment, in these fractures, contains but few or no vessels, and that it really stands in the relation of a foreign body to the joint: but this is erroneous, as vessels pass to the head of the bone along the round ligament, and are sufficient for the purposes of nutrition. Of the abundant supply to the lower fragment there can be no reasonable doubt; and upon it the principal work of consolidation falls: though, as already remarked, the upper fragment contributes something towards this result. It has, again, been affirmed that the neck of the femur is devoid of periosteum; but this is likewise untrue; it is certainly thin and delicate at this part, but still it is present, and cannot be reckoned amongst the insurmountable obstacles to union of a fracture in this position. Another objection which has been raised is, that the synovia in which the fragments are constantly bathed must render consolidation impracticable. This difficulty might appear more plausible, were it not well known that a similar condition offers no obstacle to the union of fractures involving other joints, such as the elbow and knee, in cases where the olecranon or patella is broken. No one doubts the possibility of such fractures being directly united: I have myself witnessed instances, one of which occurred some years since, and in which I afterwards had the opportunity of demonstrating the direct union of a fractured patella, without deformity of any sort. The fact is that the great difficulty lies in the perfect and accurate adjustment and relation of the fractured ends of the bone.

---

[1] Sketches of the Medical School of Paris, p. 93.

It has been justly remarked that a faulty diagnosis is pretty sure to involve a false theory and empirical practice: and this remark applies with force to the treatment of the cases I have been considering. Without much reflection, one might be apt to conclude that fractures of the neck of the femur would yield to treatment similar to that which is employed for the reduction and cure of other fractures: but here a great many difficulties present themselves. How are fractures of the cervix femoris to be reduced? Ought we to have recourse to violent extension and counter-extension? Certainly not; for this would be the very way to mar the desired result, as it would increase the tension of the muscles: but if their action could be neutralized, it is evident that reduction would be more easily effected. Then comes the question, is it possible to accomplish this desideratum? The history of dislocations readily solves this difficulty, by proving that it is practicable if the attention of the patient is otherwise engaged, and the proper moment selected for effecting the reduction.

But at this point the analogy ceases. In dislocations, the displacement being once overcome is not renewed; whereas, in fractures, the muscular contractility constantly tends to its reproduction. It therefore behoves us to seek for some other method by which to neutralize this action; and this consists in placing the limb in a semiflexed position, as was long since pointed out by Pott. Under this treatment the reduction is effected as if by magic, after having resisted the most powerful extension. It is very surprising that Pott, to whom the merit of having introduced the flexed position of limbs in the treatment of fractures in general is due, should not have said one word on its application to fracture of the cervix femoris;—a fact which may be easily verified by reference to his works.[1] I believe I was the first to point out the applicability of these rules to fractures of the cervix femoris; and I think it cannot be denied that the objections to the straight position in other fractures, hold equally in those now under consideration. Of course, suitable means are to be had recourse to for maintaining the coaptation of the fractured extremities when reduced. The position of the neck of the thigh-bone places it beyond the reach of all sorts of bandages and apparatus: and this led Desault to devise his plan of extension and counter-extension, severally from the foot and pelvis; but he does not seem to have employed the best method for carrying this principle into effect.

Here, however, I must pause, again to consider the time which is essential for the consolidation of a fracture, so that it shall be able to resist muscular action and bear the weight of the body. This must depend on the nature of the fracture: when its direction is transverse in the case of the femur, reunion is accomplished in forty days: but where it is oblique, forty, fifty, or sixty days are not sufficient for the formation of the callus; and this because the fractured ends have not the solid support which is presented by the extremities of a transverse fracture abutting on each other: moreover it must be recollected that at the close of six weeks there is only the provisional callus to maintain the relation of the fragments. Seventy or eighty days, or even a longer period is, therefore, required for the solidification of oblique fractures.

---

[1] [That Mr. Pott, in his 'Remarks on Fractures and Dislocations,' does not *specify* fractures of the *neck* of the femur amongst the solutions of continuity to be treated by semiflexed position of the limb is true: but it is to be remembered that he had no intention of entering into particulars, but merely to recommend a practice which he wished to see generally adopted. That our talented countryman meant to include fracture of the cervix femoris under this recommendation, is clear from the following passage which I quote from his works: "Two kinds of fracture there are, and only two that I can recollect (relative to the limbs) which do not admit of the bent position of the joints, I mean that of the processus olecranon at the elbow, and that of the patella," &c. (Pott's Works, vol. i, p. 413.) It should be observed that the flexed position in fractured cervix femoris is far from universally employed now; a remark, indeed, which is equally applicable to other fractures of the thigh and leg.—Tr.]

What has just been said in reference to the latter form of fracture, may be applied with equal propriety to fractures of the olecranon and patella: if the apparatus is removed at the end of forty days, the limb is found in good condition; but if the patient attempts to walk, separation of the fragments ensues. In short, these lesions are, in this respect, analogous to oblique fractures (of the long bones) in which the fractured ends have not been kept in contact for a sufficient length of time.

In transverse fracture of the neck of the femur, it is easy enough to reduce the fragments, but the difficulty is to keep them in relation; for the weight of the body tends directly to displace the upper portion, and the same cause operates, in a reflex direction, so as to force upwards the shaft of the bone. Where the fracture of this part is oblique from below, upwards and outwards, the tendency to displacement is less than in the former case. But, as it is impossible to ascertain the exact direction of the fracture, it behoves us in these injuries to employ every precaution against the risk of displacement. It follows, therefore, that, as oblique fractures of the shaft of the femur require seventy days or more for their consolidation, all fractures of the neck of the bone should be allowed at the very least this time, before the patient is permitted to use the limb.

Now, it is desirable as far as possible to reduce the practice in these cases to certain fixed rules: but as these must necessarily vary according to the age and state of health of the patient, I would lay it down as a principle that all fractures of the neck of a cylindrical bone should be kept at rest twice as long as ordinary fractures of the same bone; and even after that period I have seen displacement take place. The term may, therefore, be extended to a hundred days, or even longer in aged and feeble persons, whose powers of reparation are much deteriorated. In six cases, selected hap-hazard from a great number, consolidation had taken place at the following periods :

Age.	*Term of treatment.*
48 years	54 days
58 —	62 —
61 —	87 —
67 —	85 —
68 —	84 —
72 —	90 —

If the directions above indicated were scrupulously attended to, I may safely affirm that there would scarcely ever occur any secondary displacement, and that the amount of shortening would, at most, be but trifling.

I have already noticed the two methods of treating these fractures, viz. by extension, and semiflexion of the limb; and upon the relative merits of these I wish now to offer a few observations. But first let me remark that, occasionally, we meet with little or scarcely any displacement of the fractured ends; in which case the solution of continuity is within the capsule, and there is very trifling disturbance of the relation of the fragments, in consequence of their being locked into each other. Here then extension is uncalled for; but at the same time we must not allow ourselves to be misled by this apparent stability of the parts, but we must employ the same means for preventing displacement as if it really existed. In by far the greater proportion of cases, however, there is shortening of the limb, varying from a few lines to one, two, or even three inches; and in these instances especially, the treatment which I have recommended is serviceable and important.

In many cases where extension is attempted, the power of the irritated muscles is found more than a match for several assistants: and even when the reduction is thus effected, the shortening is reproduced as soon as the extending force is removed.[1] The best method, therefore, of effecting reduction of fractures of the cervix femoris, as of fractures in general, is to relax the muscles, and thus overcome their resistance by the semiflexed position of the limb. The following is the course I am in the habit of pursuing. The patient being placed on his back, and the pelvis being fixed by assistants, I bend the thigh on the belly by raising it, and then gently draw it from the body, the knee being at the same time flexed. This is immediately followed, without difficulty or the employment of violence, by the limb resuming its natural length, and the foot its normal direction;—an effect which is due to the relaxation of the adductors which produce eversion of the foot, and of the glutei and others which draw upwards the shaft of the bone. If, then, the semiflexed position is most favorable for reduction, it stands to reason that it is likewise best suited to maintain the fractured ends in proper relation: this was the principle taught by Pott.

---

[1] [This objection is scarcely available against the employment of a straight splint, and gradual extending force which is not relaxed.—Tr.]

Thus, of the two plans of treatment alluded to, the *modus operandi* is diametrically opposed; the one consisting in continuous extension, the other in continuous relaxation: the former of these constitutes the basis of Desault's treatment, the latter is the principle upon which I act. In the treatment by permanent extension, two opposing forces are brought into operation, one of which acts on the pelvis, and the other on the foot: and for the fulfilment of these indications various forms of apparatus have been from time to time invented and put into requisition, such as those of Hippocrates, Paré, Heister, &c. Desault superadded the employment of mechanical force to overcome the never-ceasing resistance of the muscles; and his long splint certainly possessed the advantage of simplicity, although obnoxious to the main exception of keeping the limb in a constant state of extension. As I have already stated my general objections to this plan, I shall not now recapitulate them: but as it sometimes is the independent cause of very serious mischief to the patient, it will be necessary to notice this part of the subject a little more in detail. In the first place, the skin of the pelvis and leg are pressed upon by the apparatus, so as to occasion great, and often insupportable suffering; and this may be followed by inflammation, suppuration, and even gangrene, so that when the splints have been removed at the end of three weeks, sloughs have been found on the thigh, leg, and foot, under which many patients have sunk: or, in other circumstances the intensity of the suffering has rendered the removal of the apparatus imperative, and the injured limb has been consequently shortened: this occurred in the case of General Lafayette. I have tried every means in my power to obviate these results, by carefully padding the splints, &c., but ineffectually: I have therefore renounced the plan as unnatural; and, moreover, as one which, after all, is not infrequently succeeded by shortening of the limb.

In the earlier attempts I made to treat fractures of the cervix femoris according to the new method, I was wholly unsuccessful. The apparatus I first employed consisted of two inclined planes of wood, well padded, and jointed so as to allow of the angle being varied according to circumstances: but the pressure on the ham was excessive, and in one instance produced sloughing of the upper part of the calf. I then tried the plan of placing the patient on the affected side; but the weight of the body caused inflammation and sloughing over the great trochanter, and, further, negatived the good that was otherwise effected, by displacing the fractured ends. Nearly the same effects followed the attempt to keep the patient on the opposite side; so that I was ultimately driven to adopt the original position on the back, notwithstanding the inconveniences resulting from constant pressure on the soft parts covering the sacrum and coccyx, of which inflammation and sloughing were the not infrequent consequences: yet these disasters, it should be remarked, are not peculiar to the plan under consideration, but are common to all methods, especially when the subjects are aged. The double-inclined plane which I now employ fulfils the twofold indication, of opposing the tonic action of the muscles and preventing their contraction, the thigh being flexed on the pelvis at nearly a right angle, and the leg forming a similar angle with the thigh. The muscles are thus relaxed, and eversion of the limb ceases immediately. This condition of the parts is maintained by the employment of pillows, which are arranged in the following way: one is rolled on itself and fastened thus with tapes, and then placed on the summit of the inclined planes, which are themselves formed by several others that are sewed together, and distributed with attention to regularity, the whole being covered by a sheet. One of these inclined planes extends from the ham towards the tuberosity of the ischium, the other from the ham to the heel; and the pillows should be sufficiently raised to prevent the buttocks from resting on the bed. The leg is fixed by passing a cloth, folded diagonally, across its anterior part, and making the ends fast to the bars of the bed; and a similar arrangement may be adopted with the thigh. During the first month, the thigh should be raised every day, or nearly every day, and drawn gently downwards, so as to ensure the perfect apposition of the fractured ends: and when union is judged to be complete, the double inclined plane is to be gradually lowered, by taking away, one by one, the pillows which form it, until they are all removed. The patient is not, however, to quit his bed for several days afterwards; and then he must begin to use the limb with great caution. By this method cures are easily effected; and it is exempt from the risk of serious consequences during the progress of the treatment: further, union usually takes place without shortening; or if there be any, it is so trifling as to be readily corrected by a high-heeled shoe. This form of apparatus has been charged with various inconveniences, such as giving way beneath the weight of the body, requiring constant and scrupulous attention, and generating heat and offensive odours: but all these drawbacks are amply compensated for by its simplicity and advantages in other respects. The following cases will serve to illustrate the principles which I have been endeavouring to inculcate.

Case IV. *Fracture of the neck of the femur, from a fall on the great trochanter; cured without shortening or deformity.*—M., aged 58, of small stature, but good constitution, was violently struck by a passer-by, and thrown on the left trochanter: she attempted in vain to rise, and was immediately carried to the Hôtel-Dieu: this happened in July, 1829. On admission into the hospital, the patient complained of very acute pain in the left groin and gluteal region of the same side: when placed horizontally on a bed, the left lower extremity rested on its outer side, the leg being slightly flexed on the thigh; the knee, which was directed very much outwards, was situated an inch higher than the other, which was readily demonstrated by comparing the position of the two patellæ; the foot reposed on its outer border, the toes pointing outwards, and the heel being directed towards the interval between the tendo achillis and inner malleolus of the opposite side. The acute pain in the trochanteric region and groin was augmented when the limb was rotated, and the arc of a circle then described by the great trochanter was sensibly diminished in extent: there were also considerable swelling and deformity at the upper part of the thigh. When directed to raise her foot, the patient strove ineffectually to do so, and was only able to draw it towards her by augmenting the flexion of the leg. When raised, the limb fell again for want of the support of a continuous lever; but the slightest extension and rotation inwards of the thigh sufficed to restore the normal length and direction of the extremity, which, however, were again lost when it was abandoned to itself. I had, therefore, no doubt of the neck of the femur being fractured in this case, although I could not detect any distinct crepitus when the limb was rotated. And here I may remark that this sign is always very difficult to elicit in these sorts of fracture, on account of the thick pad of soft parts surrounding the joint: moreover, it is by no means indispensable for determining the existence of the injury, and the attempt to render it apparent is not infrequently productive of fresh mischief to the neighbouring parts, and especially to the already lacerated capsular ligament. M. Sanson detected crepitus, but the method he employed requires much practice.

After bathing the patient, she was placed on a bed prepared as I have already described. At first she complained of being inconvenienced by the mass of pillows, and of pain in the knee; but the pain in the groin had ceased, and the position and length of the limb were natural. Every day there was careful attention paid to maintain the proper relation of parts; and as soon as this was disturbed by the sinking of the pillow which formed the summit of the planes, another pillow was introduced beneath the ham. Occasionally it was necessary to make the bed of the patient, and then she was moved to a temporary couch, without altering the position of the limb. On the eighty-ninth day of treatment, the limb was set at liberty; the patient could then raise the foot slightly, and the two patellæ were exactly on a level. Soon afterwards the double-inclined plane was gradually levelled by removing the pillows; and each day the movements of the limb became more extended and easy; but the patient was not allowed to lean on the limb for three weeks afterwards: she ultimately quitted the hospital without shortening or deformity of the injured extremity.[1]

The foregoing case may be justly regarded as a convincing proof that fracture of the cervix femoris may be united without deformity of any kind: and it also illustrates in a satisfactory manner the peculiar advantages presented by the treatment adopted, which is alike favorable for procuring the adjustment of the fractured ends, and maintaining their proper relation, and that without pain, or inconvenience worth speaking of. These are points of no trifling importance, when we take into consideration the ordinary age of the patient, and the length of time required for the cure of the injury. That this precaution, as regards time, is indispensable, is well exemplified in the following case, where the callus was broken through ninety days after the occurrence of the accident.

Case V.—P. J. Rocles, aged 72, a cabinet-maker, was admitted into the Hôtel-Dieu, June 10th, 1820, having fractured the cervix femoris on the left side by a fall on the hip. The characteristic signs of this injury being evident, the patient was placed on a double-inclined plane, and the case proceeded favorably. In the middle of August the planes were gradually lowered, and the limb was entirely liberated on the 1st of September. Everything appeared to promise a satisfactory result, when the patient carelessly made a false step, and again fell on the injured extremity. Acute pain accompanied this accident; and the limb, which had resumed its normal length and position, was again shortened and everted: in short, it was clear that the callus had yielded, and that the fracture was reproduced. He was again put on the double-inclined plane for a couple of months; and in the course of six weeks afterwards he left the hospital, with union of the fracture, but with the limb shortened by more than an inch.

Case VI. *Fracture of the cervix femoris; union completed in eighty-five days.*—P. J. Bequend, aged 67, of strong constitution, and usually in the enjoyment of good health, was admitted into the Hôtel-Dieu, January 9th, 1831, with fracture of the neck of the right femur, which was occasioned by a fall on the hip. The usual symptoms were present, and the limb was shortened by at least two inches. In rotating the thigh, the trochanter, instead of describing the arc of a circle, seemed, as it were, to turn on a pivot. I may remark that I do not attach so much importance to this sign as Desault did; for the attempt to make it manifest is always attended with much pain and muscular contraction, which prevents the operator from distinguishing whether the arc of a circle is really described or not: and, moreover, this sign varies in correspondence with the position of the injury, being least marked where the fracture is near to the great trochanter. Further, it is easy in these cases to restore the limb to its natural length and position, although the muscles again draw it up, and rotate it outwards as soon as it is left to itself. In simple contusions there is no deformity of this sort; and the fixed position of the limb is a sufficiently diagnostic mark of dislocation to preclude the possibility of confusing this injury with fracture.

---

[1] M. Flaubert, of Rouen, has treated many cases in the same way with equal success.

In the present case, all the ordinary signs of fracture of the neck of the femur being present, the patient was placed, as in the former instances, on the double-inclined bed: the thigh was also kept in position by a cloth, folded diagonally, and carried across it; and the sole of the foot was supported by a pad, to assist in preventing eversion of the limb. The patient expressed herself easy in this position: as the hip was very much bruised, some white wash was applied to it. After the lapse of seventy-five days of satisfactory treatment, the pillows were removed one by one, and the planes were thus levelled. The two limbs were found to correspond exactly; and as no accident supervened, she was able to leave the hospital, on the ninety-fifth day after the accident, with a useful limb.

These incontestable proofs of the value of appropriate treatment, form a striking contrast to the results of cases abandoned to the unaided efforts of nature. Even under the most favorable circumstances, when the latter alternative is adopted from choice or necessity, the power and use of the injured limb are but very partially restored; and not infrequently serious results may be produced by the irritation of the fractured ends, such as abscess, caries, &c.; and even death itself may terminate the sufferings of the patient. On the contrary, the method I employ is attended with but little suffering; all these risks are obviated, and the limb is restored, undeformed and capable of exercising its natural functions. Hundreds of fractures [of the neck of the thigh bone?] have been treated on this plan at the Hôtel-Dieu; and in an immense majority of the cases, the cure has been complete, as reference to the case-books can prove.

Before concluding I must take some notice of the dangers attending fracture of the cervix femoris, especially in persons of very advanced age. Authors mention instances of this injury being followed by inflammation of the cartilages and soft parts surrounding the articulation, and terminating in abscess and fistula: Morgagni cites examples of this nature. In our wards, patients often suffer from large sloughs over the sacrum, and on other parts subjected to pressure, accompanied by constitutional disturbance and congestion in the lungs or brain, which almost invariably cause death. This was the fate of the widow of the illustrious Desault, who, at seventy-four years of age, broke the neck of one of her thigh-bones by a fall on the hip, in 1830. MM. Dubois and Robert, who were called in, contented themselves with gently flexing the thigh and allowing it to rest on a pillow: absolute repose was enjoined, and all went on well for a time; but in the course of a month afterwards she had a rigor, succeeded speedily by difficulty and pain in breathing, and she very soon died of pneumonia.

CASE VII. *Fracture of the neck of the left femur; slough over the sacrum, succeeded by chronic enteritis, and death.*—Marguerite Laruelle, aged 67, a semstress, was admitted into the Hôtel-Dieu in 1822, with a fracture of the neck of the left thigh-bone, caused by a fall on the great trochanter some days previously. This old woman bore very well the position in which I placed her; but a large slough soon formed over the sacrum, and a month after her admission fever set in with a shivering fit, and she died in little more than a fortnight afterwards. When the body of this patient was examined, some hydatid cysts were found in the plexus choroides: the right lung was adherent throughout its whole extent to the costal pleura, and there was congestion of both lungs. The mucous membrane of the small intestines was red and injected, and presented some small spots of ulceration: there were several calculi in the gall-bladder. The fracture was found to be within the capsule, about five or six lines from the head of the bone: a fourth part of the cervix femoris was destroyed by wasting rather than caries; and there was not the slightest attempt at reparation.

Case VIII. *Fracture of the neck of the right thigh-bone; union; slough on the sacrum, tubercular phthisis, and death.*—Marie M. Tiercé, aged 74, was admitted into the Hôtel-Dieu in 1822, with fracture of the right cervix femoris, produced by a fall on the trochanter. The signs being unequivocal, the patient was placed on a double-inclined plane; but she suffered so much that it was necessary to intermit the treatment for a fortnight: it was then resumed, and she was kept on the bed for two months. At the end of this period the skin covering the sacrum was inflamed, and soon afterwards sloughed. Cough and purulent expectoration shortly succeeded, and she died five months after the accident, having, a short time before death, begun to regain the use of the limb. On examination of the body, the upper part of the lungs was found charged with tubercles, the greater portion of which were in a state of suppuration; and the rest of these organs was much hepatized. The kidneys presented an abnormal development, but no disease. The injured limb was more than an inch shorter than the other, the neck of the femur being almost entirely destroyed: the head was applied against the inner surface of the great trochanter, and rested on the smaller one: in this position it was pretty firmly united to the shaft of the bone by tough fibrous tissue, but not so as to preclude slight motion between these parts. The great trochanter surmounted the head of the bone by three or four lines. This specimen, as well as that illustrative of the next case, are in the possession of M. Marx. The sacrum was denuded and carious.

Case IX. *Fracture of the neck of the left thigh-bone; chronic enteritis, and death.*—V. de la Morienne, aged 70, was admitted into the Hôtel-Dieu in 1822, with fracture of the left cervix femoris, which had been occasioned about a week previously by a fall on the hip. The nature of the injury had not been detected by the medical man who first saw her; but as all the signs of fracture of the neck of the thigh-bone were present when she was admitted, she was at once put on the double-inclined plane. For nearly two months nothing particular occurred, but she was then seized with an active serous diarrhœa, and great œdematous swelling of the fractured limb. This was rapidly succeeded by emaciation, fever, severe pain in the bowels, delirium, and ultimately death,—which consummation occurred nearly three months after the accident.

On examining the body of this patient, serum was found poured out into the pleural cavities; the lower part of the large intestine presented some points of ulceration; and the mucous lining of the womb was inflamed, &c. The head of the femur was separated from the shaft, and lodged in the acetabulum, the fracture having been at the junction of the body and neck: the latter was quite destroyed by caries. There were no traces of the cartilage of the articular cavity; and there was also partial erosion of that on the head of the femur; but the osseous surface of the latter was not at all involved, whereas, in the acetabulum it was rough and dark. The round ligament was also entirely destroyed, and there was no appearance of synovial membrane: the capsule was perforated at several points. In the interstices of the muscles at the upper part of the thigh, and around the joint, there were several collections of dark purulent fluid. The muscular tissue was itself of a dark brown colour; and the uniting areolar tissue was either altered in character or destroyed.

CHAPTER XII.

ON FRACTURES OF THE PATELLA.

FRACTURES of the patella present for notice several points of interest, respecting which authors are still divided in opinion. I allude especially to the mooted questions of the mechanism of their production, the most desirable form of apparatus to employ in their treatment, the formation of the callus, and, above all, the possibility of obtaining direct union of the fragments.

Six cases of this kind of fracture have been under my care in the Hôtel-Dieu, during the course of the last session, in each of which the solution of continuity was transverse. Five of these cases were entirely cured without any kind of deformity, and the patients have recovered the greatest freedom in the use of the affected limbs. In the remaining case the fracture was the result of a fall on the left knee; and the injury was accompanied by considerable swelling, which depended on the presence of extravasated blood in the surrounding soft parts, and of bloody synovia in the articular cavity: nevertheless, the lesion was readily detected, for the finger could be placed in the interval between the fragments, and they could be approximated by extending the leg, and rubbed against each other so as to render crepitus distinct. In spite of the serious complication of mischief in this case, the patient has been rapidly proceeding towards recovery: but a difficulty was experienced which I have met with before in several instances, viz. that the apparatus by which the fragments are drawn together took a hold only on the skin, so that the latter was forced backwards and formed a fold which was interposed between the separate portions of the bone, thus obstructing their direct contact.

Fracture of the patella may be produced in two ways; either by a blow received directly on the front of the knee, or by violent contraction of the extensor muscles of the leg. Sometimes, however, it occurs without any remarkable exercise of muscular power; for we find this accident occasionally resulting from extension of the leg in leaping, kicking, or in trying to prevent an impending fall backwards; and one remarkable fact is, that this accident is more commonly met with amongst the middling than the lower classes. Under all the above circumstances, the patella bears only at one point of its posterior surface against the anterior part of the condyles of the femur, at the same time that the leg is semiflexed on the thigh, and the ligament and the tendon of the extensor muscles tend to draw backwards both extremities of the patella. During the muscular effort which ensues the femur constitutes the fulcrum, across which the patella is broken,—the solution of continuity commencing externally and proceeding inwards.

A great number of these fractures have been incorrectly attributed to falls on the knees; the fact having been overlooked that, under such circumstances, almost the whole weight of the body is received on the tubercle of the tibia, whilst the patella itself, being drawn upwards by the extensor muscles, can touch the surface against which the knee strikes, by its lower border only. Further, falls on the knees are very often the consequence, and not the cause, of fracture of the patella; for, directly this lesion takes place, the power to sustain the body in the upright posture is lost, and the subject of the injury straightway falls. Bodies which cut or contuse, if directed against the knees, may break the patella into several fragments; or this accident may happen in a fall, if the leg be very much flexed at the time, and the bone come violently in contact with the inequalities of the ground: but even in this case the action of the muscles has a great deal to do with the production of the fracture. It is indeed well known that a very slight blow on the knee is sufficient to excite contraction in the extensor muscles, and even moderate action in these will rupture the osseous fibres of the patella; hence probably the frequent occurrence of transverse fractures, and the rarity of those which take a vertical direction.

Thus, as I have already noticed, there are certain points of contrast between fractures of the patella resulting from muscular action, and those which are the product of blows directly received on the knee. The former are rarely complicated by the presence of contusion, laceration of the soft parts, or injury to the joint, unless after the occurrence of the fracture the patient fall violently on the injured part: the latter, on the contrary, are not infrequently attended by extensive mischief to the neighbouring textures. In some instances the patella is split into a number of fragments, which become separated from each other in various directions, at the same time that the capsule is opened and blood is extravasated into the interior of the joint. These are very serious complications of the principal injury, and may be attended with fatal results, of which the following case is an example.

Case I. *Fracture of the patella; subsequent death of the patient, and examination of the bone.*—An aged patient, who was the subject of a fracture of the patella, died in the Hôtel-Dieu in 1831, some time after the occurrence of the accident: there was not much separation of the fragments, but the injury was complicated by other serious mischief, and the patient ultimately sank with cerebral symptoms. The knee was carefully examined. At first it was difficult to distinguish the fracture; the patella was movable, but the fissure which marked the seat of fracture was only perceptible to the touch: the entire bone was readily movable from side to side. On opening the joint, its interior was found to be of a deep red colour, filled with bloody and purulent matter, in sufficient quantity to allow of its being collected with the edge of a scalpel: there had been, therefore, in this part, inflammation terminating in effusion. As to the presence of blood, that might be owing to the contusion which accompanied the fracture. The synovial membrane was very red, and this colour was dependent on the development of blood-vessels. The cartilages were also inflamed. This condition of the joint was quite sufficient to account for the symptoms which ushered in the fatal termination of the case. On the inner surface of the patella the transverse fissure, or rather groove, was perceptible, but its site was higher up than externally: the fracture had, consequently, extended from below upwards and backwards. The two fragments were, otherwise, intimately united; there was nothing interposed between them; and there was no trace whatever of the solution of continuity on the tibial side of the bone, whilst the traces of its existence on the fibular side were very slight.

A very marked difference, both in the facility with which the fragments may be maintained in proper relation, and in the permanent firmness of their union, results from the preservation or destruction of the fibrous investment of the patella; for, in fact, this fibrous expansion seems to hold the fragments together, to resist any considerable separation of them, and to form, so to speak, a basis for the material by which union is subsequently effected. It is, therefore, self-evident, how important it is to avoid injuring this structure, by roughly moving about the separate portions of a fractured patella,—a precaution which is too often overlooked in the eagerness to ascertain the nature and extent of the lesion.

Although vertical fractures of the patella are less common than others, cases of this sort are not very rare; yet there is scarcely any mention made of them in even the most modern works on surgery. One of the oldest examples on record, the only one, perhaps, which has been well authenticated, occurs in the treatise of Lamotte. The fracture, in this case, was caused by a fall from a height; the two portions of the bone were but slightly separated from each other, even when the limb was semiflexed: the treatment consisted in completely extending the leg on the thigh, and applying a moderately tight apparatus around the joint. Union was perfected in three weeks, and the patient speedily resumed his usual occupations: there was scarcely any appearance of callus.

Case II. *Vertical fracture of the patella; death, and autopsy.*—Nearly twenty years ago I admitted into the Hôtel-Dieu a middle-aged man, who had broken several bones by falling from a very great height; the left knee was very badly contused and deformed. The patient died on the third day after the accident; and, on examining the knee, a longitudinal fracture of the patella was found. This bone was divided into two nearly equal fractions, which were very movable on each other in various directions, and emitted a distinct crepitus when rubbed together: the capsule of the joint contained a large quantity of bloody fluid.

Case III. *Vertical fracture of the patella; death, and autopsy.*—About six months after the occurrence of the above case, a man was brought to the Hôtel-Dieu in a state of intoxication. He had been thrown down by a carriage, which had evidently passed over the left knee and thigh, as those parts bore traces of the iron tyer of the wheels: the patella was fractured longitudinally. This injury was readily detected, and appropriate treatment was adopted. The cure was nearly completed, when the patient was attacked with pleuro-pneumony, which terminated fatally on the twentieth day after the accident. The injured parts were carefully examined, and a well-formed callus was found, by which the fragments were united so as to permit but very limited motion between them. The articular surfaces corresponded exactly, and the whole appearance of the parts promised a perfect union in less than a month.

Case IV. *Vertical fracture of the patella; cured.*—Three years afterwards, a man came to the Hôtel-Dieu, to be treated for a varicose ulcer in one of his legs. In examining the diseased limb, I observed that the patella appeared unusually broad, and, moreover, that it presented a very distinct vertical prominence: nothing of the sort was perceptible on the opposite side. When questioned as to the cause of this deformity, the patient replied, that several years previously he had had a fall, in consequence of which his leg and thigh had been broken in several places. The patella had also been fractured; and its increased volume proved that the callus had acquired considerable development. This bone was readily moved on the condyles of the femur when the extensors of the leg were in a state of relaxation; but, at the same time, the rubbing of a considerable prominence against the condyles was perceptible. It was evident that the fracture had been vertical, and that this irregular union had been effected by nature unassisted by art, and probably in spite of a bad position of the parts. The following is another instance of the same form of injury.

Case V. *Vertical fracture of the patella.*—A servant, 19 years of age, small, dark, and of feeble constitution; suffering also from pulmonary catarrh with abundant mucous expectoration, fell from a second story into a court-yard, and wounded her head and left knee. The former injury was trifling, but she was unable to bear her weight on the injured limb. When brought, some little time after the accident, to the Hôtel-Dieu, the wound on the knee still remained ununited, and the patella was found to be fractured vertically, and thus divided into two unequal fractions. The smaller of these fragments being very movable, I thought it best to treat it as a foreign body, and accordingly removed it as I should the splinter of a comminuted fracture. The contused parts were very much ecchymosed; and there was abundant suppuration, accompanied by very acute pain along the whole extent of the limb. The constitutional disturbance gave but little hope of recovery, and the patient shortly afterwards died of the aggravation of the disease from which she was suffering when admitted. On examination of the limb, the larger fragment of the patella, which remained, presented traces of a longitudinal division.

I have treated a few fractures of the same sort, more recently in the Hôtel-Dieu; and have thus been enabled to demonstrate that this species of fracture, which has been scarcely noticed in any works, and the existence of which some authors have even doubted, is not rare: and the preceding cases further prove, what I have remarked, that this form of injury is exclusively the effect of external force acting directly on the part; and that longitudinal fracture of the patella is usually accompanied by wounds and contusions, of an extent and character which call for the special attention of those who have the treatment of them.

The diagnosis of fractures of the patella is generally simple enough. When the bone is broken transversely, the subject of the injury falls, and the limb becomes useless: on examining the knee, it is found deformed and flattened; and the separation between the fragments is readily felt, the superior one being drawn upwards by the extensor muscles, and the lower held down by the ligamentum patellæ. But if the leg is quite extended, and the whole limb raised towards the pelvis, this separation ceases, and crepitus may then be elicited by rubbing the fractured surfaces together. The swelling which supervenes about the knee is rarely sufficient to constitute a positive obstacle to the establishment of a correct diagnosis, as the joint itself is so superficial. When the fracture is oblique or vertical, a more careful examination is requisite, as the amount of separation is comparatively trifling: but this sign is, in such cases, rendered more palpable by semiflexing the leg on the thigh. Whatever the direction of the fracture may be, if swelling or any other cause should interfere with its ready detection, there is not the same inconvenience attending the delay necessary for the treatment of such symptoms, as there is, under similar circumstances, in other sorts of fracture.

The diagnosis of fracture of the patella is not, however, always so free from obscurity. A lady was brought to M. Breschet some months since, who, in going down stairs, tripped, and in the effort to save herself, felt a distinct snap in the tibio-femoral region. When we saw the patient, the swelling was excessive: the right patella, which was displaced, had a singular form, and the slightest movement caused intolerable pain. The patient then informed us that, twelve years previously, she had broken this patella, which had never resumed its natural form; and the joint became almost entirely anchylosed. In the second fall, the stiff knee had been bent, and it was difficult to establish a correct diagnosis. At first the injury was thought to be a fracture, then a sprain, and lastly a rupture or breaking through of the anchylosis. The patient, however, got well at the end of three months, but the knee remained in the same condition as before the accident.

From what I have said on the subject, the basis of the treatment of these fractures may be inferred. Rest, topical or general bloodletting according to circumstances, emollient applications, and attention to the general health constitute its principal features: and it should not be forgotten that the violence which caused the injury may likewise give rise to the functional disturbance of other organs, especially the brain.

Vertical fractures of the patella require no treatment beyond simple extension of the leg on the thigh, and a few weeks of absolute repose: the employment of any form of apparatus is entirely superfluous. But this is not the case where the fracture is transverse, for then the action of both extensor and flexor muscles of the leg is constantly tending to produce displacement and separation of the fragments. The former set of muscles act directly upon the upper fragment, but the agency of the flexors is indirect, through the medium of the tibia, to which the lower fragment is tied by the ligamentum patella. The best position for the limb in these cases is, with the thigh flexed on the pelvis, and the leg extended on the thigh.

The apparatus which I employ is of a very simple nature, and much to be preferred to those which are more complex, and proportionately more difficult to procure on an emergency,—not to take into account the greater risk of serious consequences which their application entails. The following are the articles I require: 1, Two linen bandages, of about three fingers' breadth, as long as the limb, and slit at one end, and provided at the other with two button-holes: 2, Two rollers in one, about six yards long, and of the same breadth as the bandages: 3, Two pads of a prismatic and triangular form. These are employed in the way I am about to describe. The patient being placed on a bed, an assistant is directed to grasp the heel, and raising it, to extend the leg upon the thigh, and flex the latter on the pelvis. Then the surgeon, having adjusted the fragments and intrusted them to the care of another assistant on the opposite side of the patient, places one of the bandages along the whole length of the anterior surface of the limb, taking care that the end which is not slit is directed downwards, and extends as far as the instep: this is then fixed by means of one of the rollers which is to be carried round the foot and up the leg to the lower part of the knee; and that part which was in contact with the thigh is turned downwards. The integuments being kept smooth and free from wrinkles in the neighbourhood of the fracture, the second bandage is next applied in the same manner as the first, but fastened to the thigh instead of the leg, the lower portion of it being turned upwards as the other was downwards; the knee, by this arrangement, remaining exposed. One of the pads is then to be placed above the patella, and the other below it, and the tails of the lower roller are to be afterwards passed through the button-holes of the upper, the two being thus drawn together over the pads, so as to press the fragments into close contact: the arrangement is completed by carrying the remainder of the rollers up the thigh and around the leg, so as to prevent the bandages from slipping. The limb should be kept in the position indicated, viz. on an inclined plane, the heel resting on the most elevated part; this may be accomplished by pillows or otherwise.

Notwithstanding the ordinary efficacy of this plan of treatment, it is insufficient unless backed by the willingness of the patient to be docile and submissive. This was remarkably illustrated in two cases recently under my care in the hospital; one, a turbulent, intractable young man, who would not keep quiet, and frequently took off the whole of his apparatus; the other, equally patient and compliant: the former patient went out, with separation to the extent of an inch between the fragments; in the latter, the fissure was so trifling as scarcely to admit the head of an ordinary pin. This last-mentioned instance, and many others which have fallen under my observation, have satisfied me of the practicability of obtaining direct osseous union of transverse fracture of the patella. I may further remark that I have treated other cases with perfect success, by simply maintaining the limb in an extended position, and at perfect rest, without the employment of any apparatus whatever;—a fact which naturally suggests the question of the necessity for such additional assistance as is generally employed to press the fragments together.

Case VI. *Fracture of the right patella, cured without separation, by simple position.*—Philippe A. Laudier, aged 58, an engraver, was admitted into the Hôtel-Dieu in 1820, with fracture of the right patella. The patient was feeble, and the accident was the consequence of a fall on the knee. The existence of the fracture was proved by the usual symptoms of loss of power and crepitus, attended by considerable swelling of the whole joint. The limb was placed on pillows, so arranged as to form an inclined plane from the heel down to the buttock, and the knee was poulticed. In the course of a few days the swelling had sufficiently subsided to allow of my feeling the interval which separated the fragments; and this was so trivial, that I was satisfied to dispense with any further treatment than that which had been hitherto adopted by attention to position. But, as the patient several times thoughtlessly moved his limb, I thought it right to confine it by carrying a cloth across the lower part of the thigh, and fixing its extremities to the sides of the bed. He was kept in this position, without liberty to move the limb or rise in bed until a hundred days had elapsed; the union was then perfect, and the fissure which marked the seat of fracture was scarcely perceptible.

In ordinary cases, reunion is effected mediately, through the intervention of a fibro-filamentous substance, which is developed between the two fragments. Astley Cooper and other surgeons have carefully examined fractures of the patella and neck of the femur, after subjecting the bones to the action of turpentine, and have found a transparent fibrous or fibro-cartilaginous substance between the fragments. When this celebrated English surgeon was in Paris in 1829, I exhibited to him a preparation in which the union of the fracture was immediate, and this fibro-cartilaginous matter could not be detected. No doubt, in this instance the transformation of the callus into bone was due to the length of time that had elapsed between the receipt of the injury and death of the patient. Indeed, there seems to be no reason why this result should not be expected, if we may judge by the analogous cases of vertical fracture of the patella; in which, as there is no separation of the fragments, osseous union is complete in from six to twelve months. It is, therefore, reasonable to infer that the interval produced by the muscular action is the only obstacle to direct reunion of these fractures. If not guarded against, a fold of the skin will insinuate itself between the fragments and mar the reparative process, of which untoward accident I have seen several examples. Again, another important precaution is, to take care that the bandages, or apparatus which is employed, be not too tightly applied: the most disastrous consequences may result from negligence in this particular, and are more probable when the limb is put up soon after the receipt of the injury. The following case will serve as a painful warning to surgeons, of the necessity of due attention to this point, and of the fatal effect of heedlessness in the details of surgical manipulation.

Case VII. *Transverse fracture of the patella, for which an apparatus was too tightly applied; consequent gangrene and death.*—A man, 43 years of age, fell on his right knee, and broke his patella: he was conveyed at once to one of the Paris hospitals, (not the Hôtel-Dieu.) On the day after his admission the joint was very much swollen and painful; nevertheless, an apparatus similar to that which I employ was applied, but so tightly as to cause excruciating suffering to the patient. He passed the night without sleep, and continually crying out from pain; but no attention was paid to him until the fourth day, when the surgeon at last thought fit to remove the bandages, in order to examine the limb. There were then patches of ecchymosis over different parts of the limb, with some spots of brown; yet, in spite of this significant warning, the apparatus was re-applied as tightly: the general state of the patient, however, imperatively demanded its entire removal on the following day. Gangrene speedily declared itself, attended by delirium and the usual concomitants, and as the only hope of saving the patient's life, the limb was amputated above the knee; but he only survived till the following day. On examining the patella (sixteen days having elapsed since the accident) the fractured portions were found to be about an inch apart, and still connected by the fibrous expansion from the extensor tendons, which had not been torn through: there were also some delicate bands stretching from one fragment to the other, the resistance of which seemed to contradict the supposition that they were recent productions. The fractured surfaces were smoothed by absorption; and between them there was a reddish deposit, which was softest in the centre, and almost cartilaginous where it adhered to the bone.

Vertical fractures of the patella equally require rest and complete relaxation of the muscles; and it is a mistaken and prejudicial practice to make tense the extensors of the leg, with a view to the approximation of the fractured surfaces. Experience proves that this theoretical view is ill founded, in that the flexed position of the knee produces the contrary effect of separating the fragments, probably owing to the anatomical arrangement of the osseous surfaces which are in apposition, and to the fact that the fibrous capsule is attached around the borders of the patella.

That which I consider to constitute the chief peculiarity of the treatment I recommend is, the length of time I allow for the reunion of the fracture. I am persuaded that the patella, olecranon, and neck of the femur offer no positive obstacle to reunion, when fractured, beyond that which is due to the peculiarity of their position, mechanically considered, and especially in relation to the muscles which directly act upon them. When we consider the extensible nature of the callus, and the power which the muscles have over it in either of the above instances, we can scarcely wonder that a longer period of repose should be needed for consolidation. In fact, these portions of the osseous system are in a position, as regards their exposure to displacement by muscular action, exactly the reverse of other parts: for, in the shafts of the long bones, the tendency of this active power is to produce overlapping of the fractured ends; but in the patella and olecranon the muscles separate the fractured surfaces from each other.

The indication, therefore, is to continue the treatment for a sufficiently lengthened period to allow of the formation of the permanent callus, which is capable of affording the necessary resistance. With this view I recommend that the apparatus for fracture of the olecranon should be retained for fifty or sixty days, and that the treatment of fracture of the patella and neck of the femur should extend to, at least, eighty days, and in some instances to four months and upwards. Experience has proved to me the value and efficiency of this practice, as I have found that the risk of displacement varies in the inverse proportion to the duration of the treatment: and the most convincing evidence I can offer in support of this opinion, is the fact, that I have treated on this principle upwards of fifty cases of unequivocal fracture of the cervix femoris, of the olecranon, and of the patella, and that the re-union has been so exact as not only to leave no sign of displacement, but even to render it impossible to discover that there had existed any solution of continuity.[1] The only drawback to this protracted treatment is the difficulty of inducing patients to submit patiently to the long confinement; but this is amply compensated for by the advantages already pointed out: and some little licence may be granted as the time advances, by relaxing the apparatus, and employing gentle passive motion, without risk to the ultimate and perfect consolidation of the fracture.

---

[1] [This assertion, it should be observed, exists in the original in the form of an editorial comment, though, of course, founded on the practice of M. Dupuytren. The passage has been literally rendered, and the only further comment it calls for is that such uniform success is unusual.—Tr.]

CHAPTER XIII.

ON FRACTURE OF THE LOWER EXTREMITY OF THE FIBULA; AND ON DISLOCATIONS AND OTHER CASUALTIES ATTENDANT THEREON.[1]

By *fracture of the lower extremity of the fibula,* I mean such solutions of continuity of this bone as occur sufficiently near to the ankle-joint to involve, as a consequence of the same proximate cause, (be it the weight of the body or the action of the muscles), dislocation of the foot inwards, outwards, or even backwards.

The fracture is thus the primary and principal lesion, without which there would be no dislocation. The fibula may be readily fractured without dislocation being entailed; but the latter cannot be produced without the prior occurrence of the former: it is indeed true that this luxation is both common and serious, but it is nevertheless a consecutive injury. It is on this account that I denominate the accident in question "fracture of the lower part of the fibula," in place of employing the more common appellation of dislocation of the foot *outwards:* and in speaking also of this consecutive injury, I shall give a preference to that nomenclature which is based upon the direction in which the astragalus is carried.

A just idea of the importance of this accident may be formed, by the estimate that these fractures[2] are in the proportion to all other fractures of the leg as one to three; that they are regarded by all practical writers as amongst the most serious injuries of this class; that the mischief to which they give rise is frequently the cause of death; and that, under the most favorable circumstances, they almost always leave deformity and lameness, which renders progression more or less difficult or painful. Moreover, I am unacquainted with any theory which satisfactorily explains their causes and phenomena; and it may be safely asserted that we are in possession of no mode of treatment by which a cure can be effected, unaccompanied by the usual sequences to which these fractures are obnoxious.

---

[1] [It appears from a note by the editors, that this "article" was added to the second edition of the Leçons Orales at the especial request of its author: and that it received the corrections of M. Dupuytren before going to press. The reader will perceive, in the course of perusing this elaborate paper, that it, in fact, includes all the most serious accidents to which the ankle-joint is subject, together with their complications and sequences; which unitedly form a fruitful theme for discussion and surgical observations.—Tr.]

[2] [That is, fracture of the lower extremity of the fibula.—Tr.]

The ancients scarcely noticed this accident: we may infer, indeed, from certain passages in Hippocrates, that the father of medicine was acquainted with it, but his description of the injury, from the want of anatomical accuracy, is not very satisfactory. We find no further mention made of it until the time of Petit and Duverney; and many subsequent writers, such as Paulus Ægineta, Ambroise Paré, Heister, and others, make but vague and unimportant allusions to the subject. J. L. Petit[1] pointed out that dislocation of the foot inwards or outwards involves fracture of one or both bones of the leg; but his treatment of the injury seems to have been anything but successful. More recently David attempted the explanation of fracture of the fibula, attended by dislocation, by referring it to the principle of "contre-coup."[2] According to him, the accident was caused by a violent eversion of the foot, in consequence of which the fibula was forced upwards by the astragalus, whilst it was held above by its peculiar relation to the tibia and its strong ligamentous connexions to that bone: obliged, however, to yield to the passive violence aided by the contraction of the peronei muscles, the fibula was usually broken at its weakest point, i. e. a little above the malleolus. This ingenious and plausible theory, unfortunately, is not supported by experience, which proves that forced *inversion* of the foot is the more frequent cause of the lesion in question. Yet, as this theory of its production does not necessarily lead to any error in the treatment of the injury, we are surprised to find that no success attended this surgeon in the conduct of the single case which he narrates.

---

[1] Maladies des Os. 1723.

[2] Prix de l'Académie Royale de Chirurgie, tom. iv. Mémoire sur les contre-coups, &c. 1771.

A little later William Bromfield[1] insisted on the importance of fractures of the fibula, and pointed out the disastrous consequences which a contrary opinion frequently entailed. He clearly indicated the character of displacement which follows the injury, and reprobated the malpractice of applying circular bandages: and if the compresses which he employed for the purpose of separating the bones and tilting the fibula outwards did not serve entirely to fulfil the indications, this surgeon at any rate deserves the credit of having suggested the most rational mode of treatment hitherto adopted.

Percival Pott,[2] in his general remarks on fractures and dislocations, remarks that the integrity of the two malleoli, and the close connexion of the tibia and fibula are indispensable to the firmness of the ankle-joint. But to him the merit is especially due of having pointed out the power which the peronei muscles acquire, in consequence of the loss of support occasioned by fracture of the fibula, and the resulting eversion and elevation of the foot, by which the broken end of the bone is forced against the tibia. This theory is accompanied by an engraving, the faithfulness of which is a sufficient guarantee of its being taken from nature: and so clearly did this surgeon seem to appreciate the true theory of the distortion in question, that the only mode of explaining why he did not employ the appropriate treatment for its relief is, by supposing that he was so preoccupied with his idea that it was essential to place in a flexed position all fractured limbs, that he overlooked the fact that this posture was neither sufficient to reduce the displaced foot, nor to prevent it from retaining its abnormal relations during the cure. This error was subsequently pointed out by William Hey.[3]

Pouteau, in a memoir on fractures of the fibula,[4] established the fact that these injuries may result from a simple false step, without the application of external violence, or even a fall: hence he concludes that they are principally dependent on muscular action. This surgeon also recognized the serious nature of the accident, and was aware of the deformity and lameness which so frequently follows it; but he acknowledged the insufficiency of the means usually adopted to guard against this result, at the same time that he confessed his own inability to suggest any improvement in them.

---

[1] Chirurgical Observations and Cases. London, 1773.

[2] Chirurgical Works. London, 1775.

[3] Practical Observations in Surgery. Third edition.

[4] Œuvres Posthumes. 1783.

Louis, the illustrious secretary of the Royal Academy of Surgery, has somewhere made the remark that "all curative indications are strictly referable to a proper appreciation of the characteristics which are peculiar to each class of disease and its different species." This axiom is remarkably illustrated by Fabre,[1] who, in some observations on dislocation of the foot inwards, overlooks the fracture of the fibula as the primary lesion, and is thence led into malpractice producing deformity, and leading to prosecution for damages against those surgeons who had conducted the treatment on these principles.

The works of Desault afford us no information on the subject of fractures of the fibula. Indeed, this eminent surgeon was led to conclude that these injuries had been invested with undue importance. A few years later M. Richerand published some remarks on this subject,[2] and again directed attention to the necessity of forming a just diagnosis prior to deciding on the treatment. His advice was, that side splints should be applied to the leg, to prevent eversion of the foot.

In 1808 M. Castella wrote an essay on "Fractures of the Fibula,"[3] in which he describes the accident and its effects, as they occurred in his own person; and one cannot but regret that he should have been subjected to a plan of treatment which left deformity and lameness, at a time when an improved method had already been introduced and successfully employed at the Hôtel-Dieu.

More recently Charles Bell[4] directed his attention to this subject, and properly divided fractures of the fibula into those produced by direct violence, and such as result from a twist of the foot. He also justly considered that the tendency to eversion of the foot was the circumstance which demands the principal attention; and, for the purpose of obviating this evil, he recommended the application of a long splint to the outside of the leg, extending from the knee to the foot, with the interposition of a soft pad of lint; the whole to be kept in place by an eighteen-tailed bandage, and the limb to be laid, semiflexed, on its external side. The obvious objection to this plan is, that it is both inconvenient and fatiguing to the patient, and its efficiency at best but doubtful: for both the weight and position of the foot would aid the peronei muscles in drawing it upwards and outwards, instead of fulfilling the desired object of directing it inwards.

---

[1] Recherches sur différents points de Physiologie, de Pathologie, et de Thérapeutique. Paris, 1783.

[2] Leçons sur les Maladies des Os, &c. Paris, 1803.

[3] Essai sur les Fractures du Péroné, par J. F. P. Castella. Landshut, 1808.

[4] Operative Surgery. London, 1809.

It does not appear, however, that Bell's method is generally adopted, as John Howship[1] speaks of these fractures being treated with lateral splints, and makes mention of an apparatus for supporting the ankle-joint, where eversion of the foot exists; of which I shall speak in its proper place. He does not, however, tell us whether the deformity in question results from vicious union of the fractured extremities of the fibula in contact with the tibia, which is the most frequent cause, or from simple weakness of the internal lateral ligaments of the joint.

The preceding observations will, I trust, suffice to show that, although there had been many valuable observations made, and useful precepts promulgated on fractures of the fibula and consequent dislocation of the foot, still much was required to be done in bringing together these isolated remarks, and in establishing on them a system of treatment calculated to meet and fulfil all the indications which this lesion may present.[2]

---

[1] Practical Observations in Surgery and Morbid Anatomy, by John Howship. London, 1816.

[2] [The preceding historical notice has been somewhat condensed: and the same liberty will be taken with the anatomical sketch which follows.—Tr.]

ON THE ARTICULATION OF THE FOOT, ITS BONES, LIGAMENTS, MUSCLES, ETC.

The bones.—The bones of the leg are two in number (independent of the patella); of these the tibia is the larger and stronger, and transmits the superincumbent weight from the femur, with which it is articulated above, to the astragalus. The fibula, on the contrary, is slender, especially above, and has no connexion with the femur; but it is articulated with the head of the tibia, and increases in size as it is prolonged downwards even below the base of the last-named bone: at its articulation with the outer surface of the astralagus it forms the external malleolus. The fibula, moreover, possesses a certain amount of elasticity, which it retains until a late period of life; and which, together with the comparatively trifling calls made upon its power of resistance, accounts for the numerical difference between its primary fractures and those of the tibia. The most important use of the fibula is to support the outer side of the astragalus, and to prevent the foot from turning round. The space between these two bones is occupied by the interosseous ligament and muscles.

It appears, then, that the tibia alone sustains the weight of the body, and likewise bears the shock of violence which acts parallel to the axis of the limb, as well, for the most part, as that which operates on the leg perpendicular to its axis; hence the frequent fractures of this bone; and when the fibula also yields, it is a consecutive injury dependent on the inability of the latter to sustain the superincumbent weight alone, or even to resist the action of the muscles.

But it is to the lower extremity of these bones, and their relation to the tarsus, that we must more particularly direct attention. In tracing them downwards we find them gradually assuming a relation to each other on the same transverse plane; and first of all diminishing in size, they then again expand, and this is more remarkably the case with the fibula, which is received into a hollow on the outer side of the tibia. Below this point a sort of mortise is formed by the depending malleoli for the astragalus, and this is open in front and behind to admit of flexion and extension, at the same time that lateral motion is limited. Of the malleoli the external is the longer, and the articulating surface of both bones is covered by cartilage and furnished with a synovial membrane.

The astragalus forms the highest part of the tarsus, and has an articulating surface above, which is convex from before backwards, with its edges a little raised, to correspond more exactly with the malleoli: laterally it articulates with these apophyses, and it is likewise supplied with an investment of cartilage and synovial membrane.

Thus, it will be perceived that it is the peculiar destination of the fibula to support the outer side of the articulation; and, as a natural consequence, it is in the exercise of this function, and in resisting the effects of violence directed against the external side of the joint, that it is usually fractured: and if, under these circumstances, the tibia is also broken at its lower part, it is almost always a consecutive fracture, and not the result of a direct and simultaneous action on both bones.

The ligaments.—In this, as in other joints, the ligaments and muscles have an important influence in limiting the extent of the motions which the articulation admits of. In addition to the interosseous ligament, there is a set of strong, short fibres connecting the tibia and fibula where they are in contact: the anterior and posterior ligaments of the lower tibio-fibular articulation are essential to the integrity of the ankle-joint and the firmness of its component parts during motion. The lateral ligaments of this joint connect the malleoli to the astragalus and calcaneum. Of these, the internal is single, but short, thick, and dense, and consequently very strong: it extends from the inner malleolus to the astragalus (calcaneum and scaphoid). The external lateral ligament is even stronger, and is divided into three portions; the central or perpendicular fasciculus being attached to the os calcis, and the other two to the astragalus.

The muscles which move the foot on the leg may be divided into four classes according to their position; the flexors and extensors occupying a relation anterior and posterior to the articulation, and the abductors and adductors running severally behind the outer and inner malleoli. These two latter classes have their sphere of action limited by their relation to the points of bone round which they pass; they moreover co-operate, as auxiliaries, with the extensors: it is after fracture has occurred, that they acquire the power of producing deformities which cannot occur as long as the bones retain their integrity. Respecting the relative power of these muscles, it may be observed that that of the extensors greatly exceeds that of the flexors; whilst the adductors and abductors are nearly balanced in number and strength, the greater length of the outer malleolus apparently alone giving the preponderance in favour of the adductors.[1]

Concerning some other parts situated around the ankle-joint.—Under this head are included the arteries, veins, nerves, lymphatics, skin, &c.;—in short all the textures which, from their relation to the ankle, must be more or less involved in the mischief which fractures near the joint may, and often do, entail; such as distension, laceration, compression, displacement, &c., which greatly complicate these accidents and enhance their danger.

MECHANISM OF THE ANKLE-JOINT.

The arrangements of which a brief sketch has been just given, are destined to subserve two especial purposes, namely, support, and freedom of motion in progression: and it cannot be denied that, in this as in other joints, the sacrifice of the former is necessarily proportioned to the extent of the latter.

If we regard the column which transmits the weight of the body from the thigh to the foot as a single piece, we perceive that it gradually diminishes in size as it approaches the ankle, but that the malleolar portion expands to embrace the astragalus; hence we might naturally infer that the leg would be most easily broken in its inferior third, which is its weakest part. This column, however, consists of two bones, which are so united as to form a solid medium for the transmission of the superincumbent weight, at the same time that a slight yielding motion is admitted of in the lateral movements of the foot:

---

[1] [The reader may be reminded that the flexors of the toes are extensors of the foot on the leg, and that the converse also holds good.—Tr.]

yet so intimate and firm is their connexion, that in forcibly separating the two bones, after dividing the interosseous ligament, the compact tissue of one or other will yield where the ligaments are attached, before the ligaments themselves will give way.

The base of this column is the foot: but the joint is not placed in the centre of the arch destined to support the weight of the body; for if a vertical line is dropped from the middle of the base of the femur, it falls on the upper and inner part of the astragalus, which is itself placed at the inner and back part of the foot;—a fact which accounts for the greater power of the adductor muscles. This line again divides the foot, as regards its antero-posterior diameter, into two very unequal portions, nearly three fourths being in front of, and one fourth behind, the centre of gravity.

It is by the action of the muscles that the equilibrium of the body is preserved, in the erect posture: and this equilibrium is more difficult to maintain (requiring greater expenditure of power) on one leg than on both legs. It is true that the prolongation of the foot, both anterior and posterior to the joint, tends importantly to facilitate the accomplishment of this end; but such is not the case with the lateral boundaries of the articulation, where the muscles are moreover compelled to act at a great mechanical disadvantage. It may, indeed, be urged that the extension of the base between the two feet compensates for the limited transverse diameter of one; and this is true when the body is in a state of rest: but it must be remembered that this argument is untenable as it applies to the acts of walking, running, or jumping, when the superincumbent weight almost invariably falls on each leg and foot alternately.

In viewing, likewise, the muscles that act on the several levers which the foot represents, we remark a compensating principle in the development of the former in their relation to the latter, anterior and posterior to the joint: but the inequality which is observable in the inner and outer arms of the lever represented by the breadth of the foot, is far from being compensated for by the predominant power of the adductors. And, further, the abductors seem to be aided by a portion of the flexor mass, which is on a plane external to the median line, extending from the heel forwards to the anterior extremity of the foot: the consequence of this relative disposition is, that the foot is invariably everted when the malleoli are fractured.

Under ordinary circumstances, the transmission of the weight of the body from the leg to the foot in a perpendicular direction is unattended by any ill effects: but this is not the case when the same weight is suddenly and violently transmitted, as in falls on the feet. When the point of the foot receives the jar it is broken by the elasticity of the arch, and the ankle rarely suffers, or only to a trifling extent: whereas, when the momentum is divided between the point of the foot and the heel, more serious consequences ensue, such as distension of the tarsal ligaments, breaking in of the tarsal arch, or fracture of the base of the tibia; this last injury being, by the way, analogous to fracture of the radius from a fall on the palm of the hand. But falls on the heels are by far the most remarkable, as not only causing sometimes concussion of the brain or spinal marrow, and producing contusion of the hip or knee-joints, &c.; but likewise as determining violent compound dislocation of the astragalus, usually forwards, with an inclination inwards or outwards; as illustrated in the following case.

CASE I. *Perpendicular fall on the heel; dislocation of the astragalus forwards; extraction of the bone, and cure.*—M. G., aged 50, a coach-builder, of athletic form and stout, was standing on a ladder which was placed against the back of a carriage, when the wheels, which had not been fixed, began to revolve. Thus threatened with a severe fall, M. G. collected all his strength for the purpose of leaping backwards; and in this he succeeded: but the awkwardness of his position, and the suddenness of the act caused him to alight on the left heel, which thus received the whole weight of the body, with the additional force acquired by the momentum of the fall. Excruciating pain in the foot was immediately felt, and the medical man who was first on the spot, found a large, hard, irregular, and irreducible prominence, in front of the tibia and fibula, and beneath the skin extending to the instep: there was also much blood extravasated, and a frightful amount of swelling, which increased every moment, and seemed to threaten speedy gangrene. When called in I was at once satisfied that the tumour in question was the astragalus, driven forwards into this abnormal position by the violence of the fall.

After several ineffectual attempts at reduction, the impracticability of this course was demonstrated. It then became a question whether we should cut down on the displaced bone, and again endeavour to reduce it after dividing the soft parts which entangled it: but Petit's cases did not hold out much to encourage us in this proceeding. The only alternatives remaining therefore, were to leave things alone, or to extract the astragalus: but the anticipated mischief from inflammation, gangrene, &c., did not allow me to entertain the former, and I accordingly determined on the latter.

An incision was made through the skin parallel to the axis of the foot, and the head and neck of the astragalus were immediately brought into view. These were seized, but in vain; for the posterior part of the bone was grasped and held fast between the tibia and os calcis. Surprised at this unexpected resistance, we attentively sought for the cause, and discovered, not without extreme astonishment, that the astragalus was turned round in such a way that its upper surface was directed downwards, its lower upwards, and the hook-like process at its posterior and inferior part was fixed beneath the tibia, so as completely to frustrate our endeavours to extract it. In order to accomplish our object I now fastened a piece of strong twine round the neck of the displaced bone, and, by forcibly elevating it, was enabled to disengage it from its locked position, and remove it entire, with the exception of a small fragment which was afterwards discharged.

Though the operation was tedious and painful, the patient expressed immediate relief. The wound was dressed with plain lint, and the joint was enveloped in a poultice; the limb being placed, semiflexed and on its outer side, on a pillow. He lost very little blood; and was, therefore, afterwards freely leeched over the foot, and put on a strictly antiphlogistic regimen.

He passed a quiet night, and on the following day the same regimen was enjoined. On the third day there was considerable inflammation and great constitutional disturbance. On the twelfth suppuration was established, and there was much consequent relief from fever, though the swelling continued. Up to the thirtieth day the discharge continued abundant, and the tumefaction abated: shortly afterwards the fragment of the astragalus which had been left in the wound was discharged; subsequent to which the wound gradually healed, and the patient began to walk, first with the aid of a stick, and then without any support.

I saw M. G. three years after this occurrence, when he walked with some slight degree of lameness, but otherwise as quickly and for as long a distance as before his accident.

The ligaments and malleoli are important auxiliaries to the muscles in preserving the equilibrium, which so many causes combine to interfere with. Indeed, these passive agents are even protective in some instances against injuries which, under certain circumstances, would be consequent on irregular muscular action.

The sources of mechanical resistance placed in front of and behind the joint, comprehend the elongation of the foot in these directions, the pressure of the flexor and extensor tendons, and even of the adductors and abductors, with all their strong thecæ. The lateral ligaments, moreover, play a more important part than is generally supposed in limiting the amount of flexion and extension, as may be proved by the following experiments.

Take the leg and foot of a subject, and fix the latter in a vice or between two blocks of wood so as to render it immovable; then force the leg backwards or forwards, and when you have arrived at the natural limits of extension or flexion you will hear a loud snap. If you then dissect the joint, you will find the anterior or posterior fibres of the lateral ligaments torn, or even the points of the malleoli more or less broken off. The same result may be obtained if the foot be forcibly flexed or extended on the leg; and this accounts for the sprains which are consequent on this cause.

One would anticipate that these movements ought to cause dislocation forwards or backwards; yet this accident cannot be thus produced on the dead body: when it occurs in the living, the following appears to be the explanation of the phenomenon. Suppose the foot to be fixed, for instance, under a cross beam, and that the leg obtains a fulcrum in some neighbouring body at any given point of its length; the latter is thus converted into a lever of the first order, the power which is expressed by the weight of the body being at the upper extremity of the tibia, the fulcrum in the middle, and the point of resistance at the lower extremity: the force must in this way be concentrated on the ligaments which connect the tibia to the tarsus, on the opposite side to that on which the weight of the body is acting, and dislocation then follows in that direction.

It is thus evident, I think, that the mechanism for protecting the ankle in its movements of flexion and extension, is very superior to that which is afforded by the malleoli and lateral ligaments to the sides of the joint. Moreover, dislocation backwards and forwards are extremely rare, though one would be led to suppose these accidents of almost every day occurrence, if we believe what some writers say on the subject: I have not seen more than two or three cases in fifteen years, though some hundreds of lateral displacements have come under my notice during the same period. I need scarcely add that in forced flexion and extension of the foot, the antagonist muscles are powerful agents in opposing the tendency to dislocation.

In the lateral movements of the foot the case is different; the malleoli and lateral ligaments alone limit the motions in these directions. In comparing their relative powers of resistance, the malleoli would seem to claim the first place; yet it is not so: and this may be proved by a similar experiment to that just now described. If the foot be fixed in a vice, and the leg be forcibly bent to either side, the malleoli will almost always be found broken at a variable distance from their points, whilst the ligaments as commonly remain uninjured. During life the same effect of violent sprain is continually witnessed: the ligaments retain their integrity, whilst the malleoli or even the shaft of the tibia or fibula are broken. It will be my aim by and bye to point out that this is the fact, and to illustrate it by cases.

But there are other and important conclusions to be drawn from these experiments besides those alluded to. If the foot be fixed as already described, so as to leave the ankle-joint and malleoli unfettered, and the leg be inclined with a moderate degree of force to either side, one set of ligaments will be found to yield slightly under the distending influence of the pressure, whilst the opposite are correspondingly relaxed: no laceration, however, ensues; and such is the condition under an ordinary sprain.

If the pressure be increased, a snapping sound will be heard, followed by extended mobility, announcing that resistance has been overcome. The constant appearance which then presents itself on dissection is, the separation of the compact (osseous) tissue from which the ligaments derive their attachment, or the stripping off of the periosteum into which they are immediately inserted, whilst the ligaments themselves still remain entire.

If, however, instead of conducting the last experiment slowly and deliberately, the force be applied with violence and rapidity, the mobility succeeding the snap will be found to be greater. The appearances then presented are the following: when the leg has been forced outwards, the inner malleolus *alone* is fractured, provided the impulse has been thus broken; otherwise the lower extremity of the fibula is also fractured: but when the force is applied in the opposite direction, the outer malleolus yields, yet under no circumstances is the inner malleolus consecutively fractured, as in the other experiment.

One particular is worthy of remark and of remembrance, which is this; that fracture of the extremity of the fibula, as produced by this last experiment, is scarcely ever succeeded by separation of the broken ends of the bone; and this effect is even still more rare when the tibia is broken; so that the line of fracture remains concealed beneath the fibrous tissue which envelopes the malleolus, conveying the impression that the same force was insufficient, at one and the same time to cause fracture, and displacement of the fragments.

In the preceding experiments I have supposed the foot to be immovable: but if, instead of fastening it in a vice, either margin alone be fixed, so that the whole foot may be twisted inwards or outwards, in the opposite direction to that in which the leg is moved, then the fracture of one or other of the bones, as it may happen according to the application of the force, invariably takes place at a point higher up than in the former experiments.

The summary, therefore, of what has preceded may be thus stated: that forced extension or flexion in the dead body may, according to its degree, produce distension or rupture of the lateral ligaments, or even separation of a portion of the malleoli; but it cannot cause dislocation either forwards or backwards: and again, that inversion or eversion of the foot may produce, likewise in proportion to the force applied, either simple distension of the ligaments, or stripping off of the periosteum; or a portion of the corresponding compact tissue of the malleoli may be torn away, without any laceration of the ligaments themselves,—a condition which is frequently met with in the living subject. Lastly, that the malleoli themselves give way under a rapid and violent movement of the foot inwards or outwards; and though a consecutive fracture of the fibula may, and often does, result from forced eversion of the foot after the inner malleolus has yielded, that the converse of this does not occur. These fractures of the malleoli, it may be observed, are produced by traction on their apices, which is greatly favoured by the altered relation of the ligaments, as they become more perpendicular to the points of bone from which they take their origin. I may likewise add, that the consecutive fracture of the fibula alluded to occurs at some inches distant from the ankle, and does not result from pressure of this bone against the outer side of the tarsus, but is consequent on the alteration in the line of transmission of the superincumbent weight, which, instead of passing through the axis of the limb and falling on the astragalus, is concentrated on some point at the lower extremity of the fibula; and this slender bone being too weak to sustain it, gives way, as already remarked, usually at some distance from the malleolus. In fine, the fractures of the fibula, as witnessed in the foregoing experiments, may be classed under two heads; namely, those which are primary, and the consequence of inversion of the foot, or, in other words, of traction; and those which are consecutive on tearing away of the ligaments or rupture of the inner malleolus, caused by eversion of the foot, by which the weight of the body is thrown on the lower extremity of the fibula. If the superadded agency of the muscles be taken into account, we then obtain a very correct representation of what takes place, under the operation of similar causes, in the living subject.

FRACTURES OF THE FIBULA.

The fibula, then, may be fractured by force directly applied to it, or through the intermediate agency of the foot: and these distinctions are no less important as regards their causes and mechanism, than in respect of the consequences and treatment of the resulting fractures.

Concerning direct fractures of the fibula.—The position of this bone, its slender shaft, the space there is between its centre and the corresponding portion of the tibia, and its mode of connexion to the latter bone, would all lead one to expect that it would often be broken in its middle third; yet this fracture is by no means so common as might be anticipated. Two causes tend to diminish this frequency, the protection of the peronei muscles, and the rare occurrence of circumstances capable of producing direct fracture. These lesions, which are usually unaccompanied by deformity, and which in some instances do not even prevent the patient from bearing some weight on the limb, might readily escape detection, where it not for the history of the accident, and the existence of ecchymosis and pain at the seat of injury, together with some irregularity in the shaft of the fibula, and more or less distinct mobility and crepitation.

A severe blow or the fall of some heavy weight on the fibula, gun-shot wounds, the passage of a heavy body over the outer side of the leg, are the common causes of fracture through the middle of this bone. Muscular action has no influence in producing the accident; and it is usually neither preceded nor followed by lateral deviation of the foot: moreover, a cure is effected in most instances by rest alone, and without the occurrence of any of those untoward consequences which so frequently are the sequel of fracture nearer the ankle.

Case II. *Fracture of the shaft of the fibula.*—Haudouin, aged 61, was crossing a street in Paris in 1817, when a butcher's cart struck him violently and threw him down; and the wheel passed over the outer side and middle of the right leg. He was at the moment conscious of a snapping sensation at the seat of injury; and being unable to rise, he was carried to the Hôtel-Dieu.

There was no deformity apparent in the limb, and a rather extensive ecchymosis was all that could be observed at first sight, at the spot where the wheel had passed over. When, however, the limb was raised and semiflexed, and the fingers were carried along the line of the fibula, a slight depression and irregularity were perceptible: further examination elicited the confirmatory evidence of crepitus and abnormal mobility, the lower extremity of the broken bone being very easily pressed inwards towards the tibia.

There being no displacement in this instance, I was satisfied with placing the limb on its outer side, semiflexed and a little raised, on a pillow. In this position it was fixed for thirty-five days, when the union of the fracture was complete.

CASE III. *Fracture of the fibula three inches above the ankle.*—Manuel-Jean-Baptiste Raye, aged 38, was occupied in 1817 in a cellar, when a log of wood, which was thrown down the steps, struck him on the outer and lower part of the right leg. He immediately experienced severe pain, and being unable to continue his work was conveyed to bed. Considerable swelling ensued, and some soap liniment was applied. A week afterwards he came on foot to the Hôtel-Dieu to consult me. The leg was then swollen, and presented a contusion on its outer and lower part; but as there was nothing to lead me to suspect the existence of fracture, I merely directed the patient to keep quiet and apply something to promote resolution of the inflammation. He soon, however, became tired of keeping his bed, and again went to work after six days' rest, when renewed suffering and considerable swelling of the limb obliged him to come into the Hôtel-Dieu: this occurred eighteen days after the accident.

The skin of the inferior and external part of the leg was red, swollen, tense, and painful: the tibia was uninjured, but the fibula was found fractured at about three inches from the outer malleolus, the mobility and crepitus being very distinct. There was no deformity of the limb, which was accounted for, first, by the space between the fracture and joint, by which the tendency of the peronei muscles to produce dislocation of the foot was negatived; secondly, by the action which the peronei muscles exercised in keeping the broken ends in contact, by virtue of their attachment to both fragments; and, thirdly, by the fact of the case being one of direct fracture, so that there was no disposition on the part of the muscles to act spasmodically, which would, under other circumstances, have been the case. A cold lotion was first applied to the limb, which was laid on its outer side, semiflexed : but as the patient became intractable at the expiration of a week, it was found necessary to apply the usual apparatus for fracture of the outer malleolus. He was quite well in thirty days.

The treatment, therefore, of these cases, is simple in the extreme; there being no occasion for anything beyond rest and position, with such attention as local inflammatory symptoms may suggest, unless the patient be fractious, when confinement of the limb is requisite. Nevertheless, though these fractures are not usually followed by dislocation, it is that the muscles, having had no primary share in the production of the mischief, have no tendency afterwards to complicate it : but if there should be muscular spasm, especially where the fracture is very low down, dislocation may ensue as in the other instances ;—a fact which the following case, interesting likewise in other particulars, illustrates.

Case IV. *Primary fracture of the outer malleolus and consecutive fracture of the inner malleolus.*—Pierre Robe, aged 50, of feeble constitution and delicate frame, had suffered twenty years before from a sprain of the right ankle, from which he had never entirely recovered, when he was thrown down on his left side by a coach, the right leg being extended and resting completely on its inner side. In this position one of the fore wheels of the carriage passed obliquely over its lower third, and caused a fracture, which the patient was rendered aware of by a distinct snap. Yet, in spite of this warning, he struggled violently to raise himself, which he succeeded in doing, but not without extreme suffering. He tried to walk, but the foot turning suddenly outwards he was again precipitated to the ground, and experienced another snap and a sort of tearing sensation at the inner malleolus: he was then brought to the Hôtel-Dieu. This occurred in 1816.

The foot was everted, but could be restored to its normal position by gentle traction, returning, however, to its former condition when left to itself. At the inner side of the ankle was a swelling as large as an egg, produced by the lower extremity of the tibia, which was rough, separated from the malleolus, and projecting through a rent in the skin. Externally, and about two inches above the ankle-joint, there was a considerable depression, and the outer malleolus had assumed nearly a horizontal position in following the motions of the foot: the skin, moreover, in this neighbourhood, was livid, and in a state of ecchymosis, presenting vesicles containing infiltrated blood. I thought it right to reduce the dislocation, and to apply the ordinary apparatus employed for fracture of the fibula.

On the fifth day after the limb was put up, crepitus was no longer distinguishable: on the nineteenth the wound over the inner malleolus was healed, and the leg retained the position in which it had been placed, that is, a little inverted. There was, however, some inflammation around the ankle, together with constitutional disturbance, which led me to dread an attack of erysipelas: the apparatus was accordingly removed, and a poultice placed on the outer side of the leg. Nevertheless the redness extended above the knee, and the lymphatics became inflamed and thickened. A large blister was then applied on the inner side of the thigh, which was attended with temporary relief. Prostration, however, succeeded, attended by accidental purging, for which appropriate astringents were ordered; and on the eighth day an abscess, which had formed on the upper and outer part of the thigh, was opened by a longitudinal incision, and a quantity of thick, yellow pus evacuated: the cicatrized wound also re-opened, and discharged pus mixed with flakes of albumen. It was subsequently found necessary to enlarge the opening in the thigh, and to divide the fascia lata; and from this period the patient rapidly rallied. Within a short time, however, he had two more relapses, and several smaller collections of matter were opened, but at the close of a month from the first attack of erysipelas, the fractures appeared united, without deformity, and the patient was pretty well. Yet, in spite of these severe lessons, an imprudent exposure to cold again threw him back; matter once more formed at the inner malleolus, and this point of bone was again disunited from the shaft of the tibia. And another month elapsed before he was entirely cured; the total lapse of time from the receipt of the accident being three months and a half.

ANALOGY BETWEEN FRACTURES OF THE SHAFT OF THE FIBULA, AND THOSE OF THE SHAFT OF THE ULNA.

I cannot conclude the preceding notice concerning fractures of the body of the fibula, without pointing out the striking analogy which exists between them and similar accidents to the ulna, not only in their causes and symptoms, but also in their treatment and consequences.

Fracture of the body of the ulna, as of the fibula, is always produced by a blow or fall on the broken part; or, in other words, it is the effect of force directly applied to the bone. These fractures scarcely ever entail deformity or loss of power arising from displacement: and as, in the one instance, a person with broken fibula may be able to walk, so in the other, a fractured ulna does not necessarily involve any serious interference with the use of the fore-arm. There is the same difficulty attending the diagnosis of the injury in both cases; and the treatment by rest alone, usually suffices for either. The analogy is so marked in the following case, which has been selected at hazard from several, as to render the words *leg* and *arm*, *ulna* and *fibula*, convertible terms in its narration.

Case V.—Anne Marie M——, aged 45, of very intemperate habits, was brought to the Hôtel-Dieu in a state of intoxication, from which she did not recover until the following day. She then began to complain of sharp pain on the ulnar side and middle of her right fore-arm; but as there was no impediment to the motions of flexion, extension, or rotation, a resolvent application was alone had recourse to. The pain, however, persisting, I carefully examined the fore-arm, but could discover neither abnormal mobility nor crepitus in the various movements of the arm and hand. I then carried my finger downwards along the inner and back part of the ulna, and detected a slight irregularity, which was painful when pressed. This led to a closer investigation, and by grasping the shaft of the bone above and below the joint in question, I satisfied myself of the existence of fracture, by eliciting distinct crepitus and mobility of the broken extremities on each other.

Then, and not till then, I learnt that Anne-Marie was leaving a public-house at the moment the accident occurred: she had already descended the stairs leading to the street, when, taking it into her head that she would have a drop more, she turned back; but forgetting the steps she fell forwards, and the ulnar border of the arm came in contact with the sharp margin of the stair. As there was no deformity nor probability of there being any, I merely directed that the arm should be suspended in a sling; and an accurate union was completed by the end of the month. This same patient afforded us two other opportunities of treating the same accident in the course of the year. The last time, the injury was caused by a blow which her husband had inflicted with a stick, in the vain hope of correcting her of her drunken habits: each time the same treatment was adopted with a similar result.

I must not, however, be understood as affirming that these fractures of the fibula and ulna are invariably curable without trouble or deformity: on the contrary, I have seen many instances involving both; but these are the exceptions to the rule, and it is foreign to my present purpose to treat of them. I have witnessed two or three instances in the living subject, and many in the dead, where one broken end of the fractured fibula projected outwards and the other inwards: and I remember having observed, in the persons of two or three women who had previously suffered from fracture of the ulna, that the upper fragment of this bone was forcibly drawn towards the radius: but I apprehend that this was rather attributable to the malpractice of tightly bandaging the fore-arm, than to the force which produced the accident, or to muscular action.

ON FRACTURE OF THE FIBULA FROM INDIRECT CAUSES.

The causes, mechanism, symptoms, and effects, as well as the perils, treatment, and sequences of fracture of the fibula from indirect causes, differ entirely from those which we have just considered. It is through the intermediate agency of the foot that the fractures occurring at the lower extremity of the fibula, of which I am now about to speak, are determined.

Of their causes.—The weight of the body and action of the muscles usually concur in producing this form of injury, under favouring circumstances. Thus, the following may be enumerated as the most common causes (as they are termed) of fracture of the lower end of the fibula: stepping into a hole or on a simple irregularity in the ground; the foot slipping from under the body; a fall on either side of the foot; overstepping or stepping short in going down stairs; falling, when carrying a weight, with the knee bent, and the foot inverted or everted, &c. These, however, are only the necessary preliminary *conditions;* the true and efficient *cause* of all these sprains, and fractures in the neighbourhood of the ankle-joint, with consecutive dislocation, is the combined operation, already alluded to, of the superincumbent weight acting at an advantage on the displaced or entangled foot, and the synchronous action of the muscles.

Of their mechanism.—I have already pointed out that it is the side of the joint opposed to that towards which the limb is bent, which suffers in these cases: some preliminary remarks on sprains will assist in illustrating this point, and clearing the way to the more immediate object of this dissertation.

SOME REMARKS ON SPRAINS OF THE FOOT.

Violent distension of the ligaments, commonly entitled "*sprains,*" may occur at the ankle-joint in four different directions; forwards, backwards, and to either side. The extended sphere of motion in flexion and extension greatly limits the frequency of such accidents in either of these directions; and when they occur, it is the anterior or posterior divisions of the lateral ligaments which suffer. On the contrary, the sides of this joint are very subject to sprains, in consequence of the comparatively restricted motions of adduction and abduction: moreover, one side only can be thus injured by the same accident. Whatever may be the extent and amount of pain, ecchymosis, and swelling in such cases, these symptoms have their principal seat or origin on one side of the joint, whence they rapidly spread to the neighbouring parts.

The external lateral ligaments are more frequently thus affected than the internal; a fact which seems to be attributable to the predominant power of the adductors when the joint is in a state of integrity, and also referable to the support which the opposite limb affords when the foot is bent suddenly outwards. Further, the right leg is more obnoxious to sprains than the left; which can only be accounted for by the intuitive tendency in most people to bring the right side of the body into prominent action in any emergency.

There can be no doubt, as I have already remarked, that when the outer side of the joint suffers, it is by inversion of the foot, and *vice versa:* and when the rarer examples of double sprain come under our notice, we can always trace them to the operation of two successive causes in opposite directions. As regards the relative frequency of sprains with and without fracture, the statistics of the Hôtel-Dieu, on this subject, for 1815 and 1816, give the proportion of one to seven and a half.

In the treatment of these cases, entire rest is of course most important; but pressure is also a very valuable auxiliary, as I have frequently proved, especially in sprains of the wrist: the common roller may be firmly applied so as entirely to preclude motion, and the cure is thus strikingly hastened.

The following table will serve to illustrate the results I have just mentioned.

TABLE I.[1]

WOMEN, suffering from SPRAINS, admitted into the Hôtel-Dieu in 1815.

Simple Sprains.				Total of Simple Sprains.		Double Sprains.	Sprains with Fractures.	Total of Sprains.
Internal.		*External.*						
R. Foot	L. Foot	R. Foot	L. Foot	R. Foot	L. Foot	R. Foot		
5	1	28	8	33	11	2	6	52

---

[1] [In this table, either the 1 of the second column should be 3, or the 8 of the fourth column 10, to make the calculation correct.—TR.]

TABLE II.

WOMEN, suffering from SPRAINS, admitted into the Hôtel-Dieu in 1816.

Simple Sprains.				Total of Simple Sprains.		Double Sprains.		Sprains with Fractures.	Total of Sprains.
Internal.		*External.*							
R. Foot	L. Foot	R. Foot	L. Foot	R. Foot	L. Foot	R. Foot	L. Foot		
5	1	20	9	25	10	2	1	7	45

TABLE III.[1]

MEN, suffering from SPRAINS, admitted into the Hôtel-Dieu in 1816.

Simple Sprains.				Total of Simple Sprains.		Double Sprains	Sprains with Fractures.	Total of Sprains.
Internal.		*External.*						
R. Foot	L. Foot	R. Foot	L. Foot	R. Foot	L. Foot	R. Foot		
6	7	30	6	36	13	3	7	59

ON FRACTURE OF THE FIBULA FROM INDIRECT CAUSES.

The application of the preceding remarks will be found in the fact, that sprains of the ankle and fracture of the fibula by the operation of indirect force have an analogous origin. But can these fractures severally result from no other cause than that forced eversion and inversion of the foot which produces corresponding sprains? That they may has been already shown by the experiments I have detailed, as well as the *modus operandi* of the cause; and the following cases will serve to confirm the fact.

CASE VI. *Violent inversion of the foot; fracture of the fibula, and dislocation of the foot inwards.*—Jaret, a dress-maker, aged 28, was running across a room, the flooring of which was wet, and inadvertently stepped on a bone, when a noise attracted her attention: she turned suddenly to look back, and the left foot, upon which this rotatory movement was performed whilst in the position just noticed, slipped from under her, and the whole weight of the body was thus thrown on the flexed limb, with the foot resting on its outer edge. The patient felt an acute pain, and when she made an attempt to rise she again fell, and was brought to the Hôtel-Dieu; this occurred in 1814.

---

[1] [In this table, the 13 of the sixth column has been substituted for 6, evidently a misprint in the original: and 3 has been introduced into the seventh column, as the total proves it must have been omitted.—TR.]

There was very little swelling, though the pain was severe: the foot was dislocated and twisted outwards, so that its inner border was directed downwards; and the outer malleolus could not be perceived: two inches above it was a re-entrant angle, at the bottom of which crepitation and mobility could be distinguished. On the opposite side the tibia, as if denuded of its immediate investment of soft parts, presented a bold outline through its whole extent; and its base projected as if ready to burst through the skin. Above this prominence an oblique line externally indicated the change of position the foot had assumed. All these signs disappeared on the slightest attempt at reduction when the limb was flexed, but reappeared immediately the leg was left to itself or extended.

The indications then were, to reduce the fracture and dislocation, and to retain the parts in a normal position. For this purpose my apparatus was applied, which entirely accomplished the desired object: the limb was placed in a semiflexed position, and an anodyne draught prescribed.

On the following day it was discovered that the inner malleolus was fractured. The apparatus was re-applied, and the inner malleolus was protected from compression by a circle of thick linen. In the course of a fortnight this last point of bone was no longer movable: at the close of six weeks, the patient was permitted to get up; and the week following she left the hospital well.

In the foregoing case it will be perceived that the fracture of the fibula was the consequence of violent inversion of the foot, or, so to speak, of a dragging force operating on the outer malleolus: and so far it contradicts the assertion of Pouteau and others that the reverse is always the case. But that eversion of the foot may cause a like accident, the following case will prove.

Case VII. *Violent eversion of the foot; fracture of both malleoli, and dislocation of the foot outwards.*—M. L., a butcher, aged 22, of a light figure and rather tall, was driving a spirited horse at full speed in an open cart, when, just as he arrived at the Place Louis XV, the animal took the bit between his teeth, and completely got beyond the command of his driver. L., afraid of being overturned, leaped from the right side of the cart in front of the wheel: but before he had reached the ground, the horse turned short round; and dreading that his legs might be crushed, he drew up the left one, folding it under him, and thus fell on the inner border of the right foot, which was very much abducted at the moment. He immediately experienced severe pain on both sides of the leg near the ankle, and thought at first that his inner malleolus had stuck into the ground.

When I saw the patient, the foot was twisted outwards, and appeared as if affixed to the outer part of the leg, the tibia projecting downwards. The leg and foot together formed, opposite the inner malleolus, an obtuse and salient angle, over which the skin was torn transversely, and indeed destroyed to the extent of an inch or more in diameter. At the bottom of this laceration, the broken ends of the fractured malleolus could be felt, its point being drawn downwards by the ligaments. Externally, and above the outer malleolus, there was angular depression, which, when pressed on, was acutely painful and crepitated. All round the joint, but especially on the instep and the lower and inner part of the tibia, there was a large accumulation of extravasated blood, which appeared to be furnished by the lacerated saphena vein, and oozed from the wound over the inner malleolus: the swelling and tension were already very distressing.

I determined on attempting to save the limb; and having semiflexed the knee, I had no difficulty in reducing the dislocation. My apparatus for fractured fibula was then applied, by which the parts were maintained in their natural position; and an evaporating lotion laid over the joint: an anodyne was prescribed, and abstinence enjoined.

The pain was immediately mitigated: nevertheless on the second day the skin was tense, shining, and purple, and some vesications had appeared. The apparatus was re-applied each day; and on the fifth and sixth the swelling began to subside, and the skin to assume the yellow tint indicative of progressive absorption of the blood. The slough from the ankle separated on the eighth day, and the aperture which it left gave exit to a quantity of dark blood mixed with a little pus. From this time the progress of the case was uninterrupted; and the patient recovered without the formation of any abscess, or the exfoliation of any bone. At the end of six weeks the apparatus was removed, when the foot appeared as much inverted as it had been previously everted: but this deformity was soon rectified by the action of the muscles: and ultimately, so perfect was the cure, it would have been difficult for the most practised eye to have discovered which had been the injured limb.

The preceding cases thus confirm the evidence obtained from experiment, that fracture of the fibula may be produced either by violent inversion or eversion of the foot. In the two cases it is the change in the line of transmission of the superincumbent weight which is the cause of fracture. In the former, this line, instead of traversing, as it ought, the axis of the tibia, passes obliquely from within outwards through the base of this bone and the ankle-joint. The weight is thus thrown on the outer malleolus and lower extremity of the tibia, and some part of the malleolar extremity of the fibula gives way. The tibia usually resists the force; and if it yield at the inner malleolus, the fracture is consecutive, and dependent on the displacement of the foot outwards. In forced inversion of the foot, however, it is the internal malleolus and lateral ligament on one side, and the lower extremity of the fibula on the other, that receive the shock from the transmitted weight; and it is the former which first gives way, and the latter consecutively.

But which of the above causes is the more frequently followed by fractured fibula? This is a question of little practical importance, as the treatment must be the same in either case; and moreover it is not generally very easy of solution; for the confusion occasioned by the accident usually incapacitates the subject of it from giving a correct statement of the mode in which it occurred, and the seat of pain is referred to as the point on which the injury was inflicted, whereas the latter may really be situated at a considerable distance.

SIGNS OF FRACTURE OF THE FIBULA, FROM INDIRECT CAUSE.

These signs may have reference simply to the fracture, or to the frequent complication of dislocation of the foot; and they are divisible into two heads, the *presumptive* and the *characteristic*.

The presumptive signs are, the nature of the accident; a noise or sort of cracking sensation experienced at the time; a fixed pain at the lower part of the fibula, combined with difficulty or total inability to walk; and more or less of tumefaction around the ankle-joint, especially on its outer aspect. The characteristic signs are, abnormal mobility at some point of the lower extremity of the fibula, attended by crepitus; extended mobility of the foot from side to side, together with facility in pressing the fibula inwards towards the tibia; an alteration in the point of incidence of the leg on the foot, and the deviation of the latter outwards and sometimes backwards, together with rotation on its axis from within outwards; a more or less marked angular depression at the outer and lower part of the leg, and prominence of the inner malleolus; lastly, the disappearance of all these signs as soon as an attempt is made to reduce the foot to its normal position, and their immediate reappearance when this effort is suspended, more especially when the leg is extended.

Presumptive Signs. (*a*) *Nature of the accident.*—This sign is not of much value, taken by itself; partly for the reason already given, that the patient is frequently incapable of giving a correct account of it, and partly because the same cause may, from the agency of modifying circumstances, produce very different effects. Nevertheless, a violent inversion or eversion of the foot, when walking on uneven or slippery ground, or in coming down stairs, &c., should lead one to suspect the possible existence of fracture of the fibula, and induce a careful inspection of the parts which may be concerned in the injury.

(*b*) *The cracking sensation and noise* of which the patient is conscious at the time of the accident are too constant as signs of fractured fibula to be passed by unnoticed. It must, hov be remembered that so many circumstances may prevent the patient from remarking these indications, that they cannot be placed amongst the characteristic signs.

(*c*) *The seat of pain* is more to be relied on, though this also may depend on simple distension of the ligaments. Yet, when it is experienced at the moment of the accident, and persists, without changing its locality, at the lower part of the fibula, and is not excited when pressure is made below the malleoli, it can scarcely be mistaken for the pain of simple sprain. It is true that a contusion would be accompanied by the same local pain, and therefore this sign requires the presence of others to confirm the existence of fracture: but very many times it has occurred to me to have my attention first arrested by the sign under consideration, in carrying the finger along the fibula; and I have thus been led to the detection of other and characteristic signs which confirmed my suspicion that the fibula was fractured.

(*d*) *Partial or entire inability to walk* may result from too many causes to allow of much importance being attached to it; yet there are some circumstances associated with this sign which require notice. For instance, the lameness dependent on a sprain is due to the pain the effort occasions: now, this pain diminishes and sometimes entirely subsides under exercise, but returns after a short rest. But the effect, in fracture of the fibula, springing from a distinct cause, is itself quite different; for the suffering increases with exercise, and the foot soon becomes everted.

(*e*) The *swelling* is a more important sign, on account of its varying locality. In distension of the ligaments and contusion of the ankle-joint, the tumefaction is usually confined to the injured parts. In fractured fibula it is generally less than in sprain without fracture; and when present, it is always above the malleoli and on a level with the seat of fracture. In some instances there is a further swelling around the inner malleolus; in which case it will be almost always found that, after the receipt of the first injury, the patient has attempted to walk, that the foot has yielded by eversion, and that thus a consecutive distension of the internal lateral ligament has ensued, accompanied by swelling at the corresponding part of the articulation: this last sign may therefore be regarded as confirmatory of the former, in establishing the nature of the accident.

I have already remarked that the preceding signs, whether individually or collectively, are not to be regarded as alone sufficient to prove the existence of fracture: but that they render such surmise highly probable the following case will prove.

Case VIII. *Existence of presumptive signs only; subsequent development of characteristic signs.*—M. D. was walking on a narrow causeway, when the ground gave way beneath his left foot, and the body lost its support on that side. A rapid movement transferred the weight to the right leg, but the earth continuing to yield, the patient fell, and slipped into a ditch by the side of the road, the momentum being received on the inner side of the right leg, which was twisted and bent up under him. He felt acute pain at the moment and could not rise; but was conveyed home without having attempted to walk or bear any weight on the injured limb. When called in, eight or ten hours after the accident, I found the foot and leg in their natural relations to each other. There was no trace of abnormal mobility, nor other indication of fracture; the patient was free from pain whilst the limb was semiflexed, a position he had himself instinctively assumed; and he did not complain when I made my examination, but was able himself to move his foot without suffering. Nevertheless, he could not lean in the slightest degree on the affected limb, without causing acute pain above the outer malleolus: and when I made pressure at this point, the act always elicited an exclamation of pain. At the same spot there was an ecchymosis, which extended upwards along the fibula and downwards beneath the outer malleolus: but I could detect neither mobility nor crepitus, nor deviation of the foot outwards or backwards, which collectively constitute the only characteristic signs of broken fibula. I felt persuaded, however, that there was a fracture where the pain was felt; but as there was no displacement I was satisfied with treating the case as one of simple sprain, by position and rest.

This course was successfully pursued for several days, and the swelling had already in great measure subsided, when an officious friend of the patient suggested that it was very unnecessary for him to keep his bed, and that it would be far better to try what he could do with his leg, as his health and the foot itself would ultimately suffer from want of exercise.

The patient lent an ear to this foolish advice, which seemed to be backed by the total absence of pain in the injured part. He got up, and was at first careful scarcely to touch the ground with his foot: but gaining confidence from impunity, he determined on the following day to try how far the limb was capable of supporting his weight: but hardly had he made the hazardous experiment, than he felt an acute pain accompanied by a cracking and tearing sensation: he immediately fell and was unable to rise again. Being again sent for, I discovered this time the dislocation of the foot outwards, with mobility and crepitus, which I could not detect before. I applied my usual apparatus, and the patient was perfectly well at the end of six weeks. This is not the only case of the sort I have witnessed.

I now proceed to consider in detail the several *characteristic* signs, the importance of which, whether separately or conjointly, greatly exceeds that of the presumptive signs I have already passed in review.

(*a*) The practitioner must guard against confusing the *irregularities* resulting from fracture of the fibula, with the sharp margins and ridges which exist at the lower extremity of the fibula. The distinctness of the former depends on the amount of displacement and complication of the fracture: and may be always felt, and sometimes seen, projecting beneath the skin, which in some instances they actually penetrate.

(*b*) *Unnatural mobility* must be carefully distinguished from the natural flexibility of the fibula: though, it is true, the mistake cannot well be made at the lower extremity of this slender bone. The mobility of fracture is limited to a single point, which is, moreover, the especial seat of pain; and it is most readily elicited by grasping the tibia with the fingers of either hand, whilst the two thumbs are pressed alternately against the fibula, above and below the supposed seat of fracture.

(*c*) In this way also, or by alternate eversion and inversion of the foot, the next sign of *crepitus* may be detected. But this evidence of fracture is inconstant in amount, and even in its existence, depending on the extent of fracture, its inequality, the separation of the fractured extremities, the interposition of soft parts, &c.

(*d*) *The displacement of the fractured ends* can scarcely exist without inversion or eversion of the foot: moreover it is the lower fragment which is almost always displaced; it is thrust inwards towards the tibia, being tilted, as it were, in this direction, over the upper and outer part of the astragalus, every time that the foot is forced outwards. Yet the point that is felt is that of the upper fragment, which is rendered prominent (though itself unmoved) by the sinking in of the lower fragment. The latter, however, may be thrown outwards, though this is rarely the case; and when it occurs, it is either the immediate consequence of the force which determined the accident, as in violent inversion of the foot, or the effect of that rare combination of circumstances by which the foot, instead of being everted, is inverted, as I have sometimes remarked in fracture of the lower extremity of the fibula and tibia. However this may be, the displacement may readily be detected by the finger, or is obvious to the eye.

(*e*) *Movement of the foot from side to side.*—In the normal condition of the ankle-joint, the malleoli and their ligaments preclude the possibility of moving the whole foot from side to side, or horizontally; for the inclined movements of abduction and adduction do not belong to this class. But this unnatural mobility is very extensive when the lower part of the fibula has been broken, and it may be remarked by moving the foot outwards, when the knee is bent and the leg fixed: the inner malleolus is thus brought into relief, but again sinks when the foot is restored to its natural position. These movements further serve to distinguish fracture of the fibula without displacement from simple sprain, as they are necessarily accompanied by crepitation between the fractured ends, or by displacement, which are neither present in the latter form of injury.

All these signs appertain exclusively to fracture of the bone; and when the influence of the cause which determined the injury is arrested here, the signs attendant on dislocation are not present, as this is a consecutive effect. The following case will illustrate this peculiarity.

Case IX. *Fracture of the lower extremity of the fibula, indicated by characteristic signs; without dislocation.*—Marie-Anne Gaimpel, aged 50, and very stout, was going down stairs with a basket on her back, heavily laden, when a false step threw the whole weight suddenly on her left foot, which was advanced, and internal to the centre of gravity: the consequence was that she slipped down, the momentum of the fall being received on the outer side of the limb thus awkwardly placed.

The patient was immediately taken up and carried to the Hôtel-Dieu. A long line of excoriation occupied the outer aspect of the leg and foot, the latter being swollen, bruised, and painful on its fibular side: she was quite unable to bear the least weight on the limb.

When the finger was carried along the fibula, acute pain was felt, and prominent irregularity detected, about two inches from the point of the outer malleolus. Distinct crepitus and mobility were likewise perceived when the fibula was pressed with the thumbs, whilst the fingers rested on the tibia: and, lastly, the foot could be moved horizontally outwards; but until this experiment was made there was no sign indicating dislocation of the foot outwards, for the axis of the leg was natural, and there was neither rotation of the foot, nor prominence of the inner malleolus, &c.

My usual apparatus was applied, and the limb was laid, semiflexed, on its outer side on a pillow. This arrangement was renewed every five days, and at the end of six weeks the fibula was examined; but as it was found that union was not yet complete, the apparatus was reapplied for three weeks longer, when it was permanently removed. At this time the foot was very much everted, but a few days' liberty sufficed to set this right, and the patient soon recovered the perfect use of the limb.

(*b*) *The change in the point of incidence of the axis of the leg on the foot* is, when present, one of the most striking signs of fractured fibula: for the tibia and shaft of the fibula, which really retain their natural position, seem, as soon as the foot is everted, to be driven inwards as if by some force acting directly on them. The change indeed is so remarkable, that if the axis of the leg were prolonged downwards, it would pass internal to the astragalus, and thus exclude nearly the whole foot, which would be external to the plane described. This unequivocal sign accounts for patients being wholly incapacitated from bearing upon the sole of the foot; as it is in fact only the inner border of the foot in these cases which comes in contact with the ground.

The explanation of this deformity is the lost support of the fibula, and the contraction of the peronei muscles; the tibia and shaft of the fibula being really fixed, whilst the foot is drawn outwards. The centre of this abnormal motion extends in an oblique line from the inner malleolus, through the ankle-joint to that point of the fibula which is the seat of fracture. An excellent representation of this will be found in Pott's works, where he is treating of this subject.

(*g*) *The displacement of the foot outwards* is the consequence of the mobility of which I have spoken, brought into play by the weight of the body or action of the muscles: the foot then, by a horizontal movement, quits the lower surface of the tibia, to assume a new position entirely or partially external to the axis of the leg. The extent of this displacement varies from a few lines to an inch and a half: when considerable, it constitutes one of the most manifest proofs of fractured fibula; and when slight or absent, it may be produced or augmented by lateral movement of the foot: and in this way this sign often becomes evident or disappears in applying the dressings or changing the position of the limb. One of the most remarkable but mischievous effects of this displacement is, that the tendons, ligaments, vessels, and nerves around the joint are necessarily put on the stretch, and not infrequently contused, compressed, or even torn. In this way many disastrous consequences of the accident under consideration may be accounted for, such as the pain, spasm, inflammation and its sequences, suppuration, and gangrene, which are more likely to occur when the cause is not immediately removed by reducing the dislocation.

(*h*). *Rotation of the foot on its axis.*—It is not by a simply horizontal movement that the foot is carried outwards in these cases of fracture of the fibula; but the direction which it takes is oblique, from within outwards and upwards. In this way the foot is rotated on its axis, so that the summit of the astragalus is forced inwards, and the sole of the foot is directed outwards. The amount of this rotation is always in direct proportion to the outward displacement, and is referable to the same causes, which are brought into operation on the patient attempting to walk, after the fibula has been broken. In like manner it is to this compound movement that permanent deformity and lameness are due, in cases which have been mistaken or maltreated.

(*i*) An invariable result of the preceding mechanical changes is, *an augmentation of the space comprised between the two malleoli*. This increased breadth should be cautiously distinguished from that which is consequent on ecchymosis and swelling of the soft parts: but any error of diagnosis arising from this cause may be obviated, by placing the finger and thumb of one hand firmly on the two malleoli, and then comparing the diameter with that of the other foot handled in like manner.

(*k*) *Prominence of the tibia* at the inner side of the leg, and *an obtuse salient angle opposite the inner malleolus* are further consequences of the same cause; the dislocation of the foot outwards leaving these parts unnaturally elevated beneath the skin, to an extent varying with the amount of the displacement. In some instances the mischief is complicated by fracture of the inner malleolus, and the joint is laid open; which of course adds much to the serious nature of the case. Beneath the malleolus there is usually a hollow, or at any rate no resistance to the finger when pressed inwards, which proves the absence of any other bone at this spot.

(*l*) *The re-entrant obtuse angle* situated at the outer and lower part of the leg, is more strongly marked when the foot is forced much upwards and outwards, and constitutes one of the most certain and palpable proofs of the fibula being broken and its fractured ends displaced: for the malleolar extremity of this fragment being tilted outwards by the outer part of the astragalus, the upper or broken end of the same is forced inwards against the tibia. At the same time the fractured extremity of the shaft of the fibula, being free, forces its way downwards and outwards against the skin, which it sometimes pierces: so that, in carrying the finger downwards along the outer surface of the leg towards its lower part, a prominence is first felt formed by the lower end of the shaft of the fibula; immediately below this a marked depression; and still lower the outer malleolus more or less directed upwards.

It is remarkable that, in fracture of the lower extremity of the radius, the same angular depression is observable on the side of the fractured bone, and the same salient angle on the ulnar side; and that these angles are in this case, as in fracture of the fibula, the most conclusive evidence of fracture of the radius.

(*m*) *The sudden disappearance and return of all the symptoms*, is an alternation frequently observable in these cases, and dependent on muscular spasm, extension of the limb, slight efforts at reduction, &c. The facility with which these changes are effected is a proof, not only of the fibula being broken but, of extensive laceration of the ligaments, and of the fracture being a loose one.

I may, however, here remark that the foregoing observation admits of a more general application, and constitutes a very valuable source of diagnosis between fractures near to joints and dislocations generally: thus, fracture of the neck of the humerus and dislocation of the head of that bone, fracture of the radius and dislocation of the wrist, fracture of the neck of the femur and dislocation of its head, may be so distinguished. In short, slight extension annuls the deformity in cases of fracture, but the affected part resumes its abnormal form when the extension is discontinued: whereas, it requires considerable force to reduce a dislocation; but, once reduced, considerable resistance is (usually) offered to the re-displacement of the bone and the reproduction of the deformity. The following case will serve to illustrate some of the preceding remarks.

CASE X. *Dislocation of the foot outwards, with fracture of the fibula.*—Jean Trouillé, aged 26, a porter, slipped on some damp pavement, and fell on his right side, his foot being adducted and his leg bent under him. He experienced acute pain at the moment towards the bottom of the leg, and finding he was unable to rise, he got one of his fellow-workmen to carry him home on his back: on the following day he was admitted into the Hôtel-Dieu. This occurred in January, 1813.

The following symptoms presented themselves. The foot was so far everted as to be entirely external to the axis of the leg: and the rotation of the former was such that its inner border was directed downwards, and its plantar surface inwards. The tibia and its malleolus were prominently in relief, the skin over them being very tense, and presenting numerous vesicles filled with bloody serum. On the opposite side the depression was correspondingly deep, the skin being thrown into a transverse fold about two inches above the outer malleolus. All these abnormal relations disappeared on the slightest attempt at reduction being made, but were spontaneously reproduced when the extension was discontinued.

In addition to these signs of dislocation of the foot outwards, there was acute pain at the lower extremity of the fibula, irregularity, mobility, crepitus, and so great facility in carrying the foot horizontally outwards, as to leave no doubt of a loose fracture of the fibula; at the same time it seemed highly probable that the malleoli were broken, and the lateral ligaments ruptured. There was, further, a large ecchymosis opposite the seat of fracture and the inner malleolus, which extended over the corresponding surfaces of the foot and leg. The tension and pain were moderated by bringing the foot into its natural position. A poultice was applied.

On the following day the swelling and tension were increased by œdema of the parts, and I thought it desirable no longer to delay restoring the limb to its natural form, and putting it up in the apparatus I usually employ in these cases. With this view I flexed the knee and had the upper part of the leg fixed by an assistant: another made gentle extension by grasping the heel with one hand and the instep with the other; the foot was at the same time carried inwards. In this way the reduction was effected, and I retained the parts in their natural position by my apparatus, placing a pad and splint along the whole length of the tibia, by which I was enabled to act on the foot so as to draw it inwards, and at the same time that the tibia itself was pressed outwards. An evaporating lotion was applied, and the limb was placed on a pillow, semiflexed, on its outer side.

For several days this patient had much fever and local inflammation, requiring general and topical depletion, and an antiphlogistic regimen: and at the close of a week there was a large, fluctuating sac extending from the head of the fibula towards the seat of fracture. Being persuaded that this was filled with blood, I continued the application of an evaporating lotion with the addition of a little camphorated spirit: the swelling gradually subsided, and had nearly disappeared at the close of the third week. In six weeks the union of the fracture was complete; and a fortnight afterwards he left the hospital quite well, there being no deformity, and the patient being able to walk without difficulty or pain.

SPECIES AND VARIETIES OF, AND COMPLICATIONS AND CASUALTIES ATTENDING, FRACTURE OF THE FIBULA.

It will be perceived, from the preceding cases, that fracture of the fibula is rarely a simple accident, but that it is almost always accompanied or followed by complicating circumstances, which impart to it an importance it would not otherwise possess. Of this class are the following conditions: rupture of ligaments, fracture of the inner malleolus or of the tibia itself; dislocation of the foot inwards, backwards, and, in some cases, outwards; dragging upwards of the astragalus and foot; extravasation of blood, laceration of the skin; and such sequences as inflammation, gangrene, &c. These I shall in due course pass successively in review.

Simple fracture.—This occasionally occurs without any complication, but is only witnessed when the fibula is broken at some distance from its lower extremity, and when the force producing it has been exhausted immediately this lesion has been effected, and no fresh cause has been called into operation. The only evidence that can be obtained of this injury is presumptive, such as the nature of the accident, the cracking sensation or sound already referred to, the fixed site of the pain, and the corresponding swelling; the absence of both swelling and pain opposite the lateral ligaments; inability to bear any weight on the limb, and the persistence of these symptoms beyond the usual period of the duration of some of them in simple sprain. The eighth case which has been cited aptly illustrates this condition, prior to the patient's foolishly yielding to the impertinent suggestions of his friend. But as soon as any cause, such as muscular action, the weight of the body, &c., has been called into operation in sufficient force to produce any of the more serious complications (such as the sequel of the case first referred to likewise illustrates), then of course the accident no longer belongs to the class which we now have under consideration. The risk of these serious complications sufficiently indicates the importance of scrupulous abstinence from any sort of movement, when there is reason to suspect fracture; more especially as rest alone is all the treatment that is necessary, when carefully adhered to for a suitable time.

Varieties of simple fractures.—These may be divided into two classes; that in which the fracture is within three inches of the lower extremity of the fibula, and that in which it is higher: in the former class of cases alone can the complicating accidents to which I have alluded occur.

The distinguishing characteristic of the latter variety is, that it is not and cannot be attended by displacement of the foot; an impunity which is due in part to the length of the lower fragment, and partly to the integrity of the tibio-peroneal ligaments. It is almost always the consequence of force operating directly on the bone, and is scarcely ever produced by an indirect cause.

Where the fracture is within the limit of three inches from the point of the outer malleolus, the complications alluded to may or may not occur, according to circumstances; and this injury may be occasioned either by the direct or intermediate agency of external violence. The most common site of this form of fracture is at about two and a half inches above the extremity of the fibula, where this bone is most weak and slender, and where it is bent inwards by the superincumbent weight of the body and the action of the muscles: it is at this spot, therefore, that the least resistance is offered, and that the causes capable of producing fracture act at most advantage, as for instance in forced eversion of the foot. Lastly, the fracture sometimes occurs below where the ligaments connect the tibia and fibula together: but then it is rather a fracture of the malleolus, and is consequent on inversion of the foot. All these varieties may be readily recognized by the mobility and crepitus attending them; and they acquire an adventitious interest from the risk there is of their being followed by dislocation of the foot.

COMPLICATIONS.

First complication. Rupture of the internal lateral ligament.—This and fracture of the inner malleolus are the most common complications accompanying fracture of the fibula; and they are produced by modifications of the same cause. They may either precede or follow the latter accident; the former is the case when violent eversion of the foot is the cause in operation, but they are consecutive when produced by inversion of the foot. In the first case they are effects of the cause which, in breaking the fibula, also operates at the same time on the inner side of the ankle-joint and the lower extremity of the tibia. In the second case, the rupture of the ligaments, the tearing away or fracture of the inner malleolus are produced in a different way; and for this effect to occur, it is necessary that, after the fibula has been fractured by inversion of the foot, the latter should be everted, which is accomplished by the patient attempting to stand, and by the abductor muscles being called into action: this complex result ultimately terminates in dislocation of the foot inwards. Rupture of the internal lateral ligament can only be distinguished by the pain and ecchymosis at the part; by the prominence of the inner malleolus when the foot is carried outwards, and by the practicability of moving the foot horizontally from side to side. It is of no great importance, as the fracture of the fibula unites just as well, and the use of the foot is not afterwards impaired.

Second complication. Separation of the point of the inner malleolus is of more common occurrence than rupture of the ligament, to which in its symptoms it is closely allied. It calls for no particular treatment beyond that which is requisite for fracture of the fibula.

Third complication. Fracture of the inner malleolus may be simple or compound. When the attendant swelling subsides, it may be detected by the furrow or groove extending transversely between the malleolus and shaft of the bone; and the former may be grasped and readily moved on the latter. The isolated malleolus always follows the motions of the foot, and may be thus separated from the tibia when the foot is abducted. It is kept in good position by my apparatus for fractured fibula.

It is a remarkable fact that fractures of the malleoli and olecranon, and longitudinal fractures of the patella unite readily and in a short time; whereas fractures of the neck of the femur, and transverse fractures of the patella unite tardily and with difficulty.

The following case will serve to illustrate most of the points alluded to, in connexion with fracture of the inner malleolus.

Case XI. *Fracture of the fibula and inner malleolus; dislocation of the foot inwards.*—Louise Grandjean, aged 45, fell, in 1809, backwards and to the right side, having the left foot wedged in between two compartments of the pavement: she immediately experienced acute pain at the lower and outer part of the leg; and when she attempted to stand, she again fell and was carried home. Some lotions were applied for a couple of days, and then she was brought to the Hôtel-Dieu, where, in spite of the swelling, fracture of the lower extremity of the fibula was recognized, by the usual symptoms of pain, mobility, and crepitus, &c.: the foot was also everted so that its plantar surface was directed outwards, and the foot could be moved horizontally from side to side.

In addition to the above evidences of broken fibula, there was a large patch of ecchymosis about the inner malleolus, which spot was acutely tender: the lower extremity of the tibia projected very much, pushing the skin before it, and appeared irregular and shorter than natural; below this was a deep fissure, and still lower down was a loose piece of bone which could be grasped and moved about, following the foot in its motions: this fragment was clearly the inner malleolus, which retained its connexion with the foot through the medium of the internal lateral ligament.

My apparatus for fractured fibula was applied, and by it the parts were all kept in their normal position. In five weeks union of the fractures had taken place, and there was no trace of deformity. A fortnight afterwards the apparatus was entirely removed, and the patient began to walk. There was not the slightest interference with the perfect use of the limb, when she had regained her strength.

In this as in analogous cases, and they are numerous, the fracture of the inner malleolus was the result of force, primarily or consecutively exerted by the weight of the body and the abductor muscles, on the inner side of the ankle-joint. This apophysis may, however, be fractured by force directly applied to it, and this lesion may be unattended by any dislocation of the foot; of which the primary injury in the following case will afford an example.

Case XII. *Fracture of the fibula and inner malleolus.*—Pierrette Legros, a rag-gatherer, aged about 40, was knocked down on her side by a cabriolet, the wheel of which passed nearly transversely over the left leg, which was lying on its outer side. As there was no *apparent* mischief to the bones, the patient got up and walked in spite of the pain she suffered; but after going a few paces, the foot suddenly gave way by eversion; she heard a snap, and felt an acute pain at the same moment at the lower part of the fibula: being supported, she did not again fall.

When brought to the Hôtel-Dieu, the signs which have been detailed in the last and preceding cases, as evidence of fracture of the fibula low down and of the inner malleolus, were present; the latter being the primary, and the former the consecutive, injury. The same treatment was adopted as in the case last narrated, and with the same happy result, union having taken place in little more than a month.

Fourth complication. Fracture of the lower extremity of the tibia.—Instead of the lateral ligaments and the inner malleolus, it is sometimes the lower extremity of the tibia which gives way. This injury is almost always consecutive on fracture of the fibula, and is determined by the continued operation of the same cause, the extremity of the tibia itself being the fulcrum when its shaft is broken. But sometimes the injury to the fibula is consecutive; for when the tibia is broken, and the patient makes an effort to stand or walk, the former slender bone readily gives way beneath the superincumbent weight.

This fracture is almost always oblique and accompanied by displacement of the foot. The direction of the obliquity is dependent on the nature of the force and its *modus operandi;* and the character of the fracture, again, determines the direction of the dislocation, which may be backwards, inwards, or outwards, but most frequently the first, as the tibia is oftenest fractured obliquely from before backwards, and the extensor muscles of the foot are moreover the strongest in this region.

CASE XIII. *Fracture of the tibia and fibula, with dislocation of the foot backwards.*—Françoise Cécile Michel, aged 48, was in the act of going down stairs, in 1815, when her left foot suddenly gave way by eversion, and she at the same moment felt a sharp pain at the lower and outer part of the leg. The weight of the whole body being thus thrown on the inner malleolus and inner side of the knee, the limb was incapable of supporting it in this position, and a second and more acute pain was then experienced at the inner and lower part of the leg.

Being unable to rise, the patient was immediately conveyed to the Hôtel-Dieu, when abnormal mobility and crepitus were detected, indicating the existence of fracture at the inferior part of the leg. In short, the eversion of the foot and angular depression, &c., above the outer malleolus, showed that the fibula was fractured; moreover, the foot was extended on the leg and displaced backwards, being accompanied by a fragment of the tibia which was broken off from the shaft of the bone.

The house surgeon reduced the parts to their natural position, and placed the limb in the ordinary apparatus for fractured leg; but on the next day, they had resumed their abnormal condition, and there was much swelling. I therefore again restored the displaced parts, and placed the limb in my apparatus for fractured fibula, and laid it, semiflexed, on its outer side. The inflammation and pain after this abated, though it was requisite to bleed the patient. Yet, there was still a disposition to displacement of the foot and of the fractured tibia, and it was necessary to keep them pressed back into their proper position. Some sloughs formed on the eighth day over the seats of fracture of the two bones, which separated on the thirteenth, when suppuration became more profuse: the apparatus was then removed. This step, however, proved to be premature, for the fractured ends of the bones were again displaced, and it was necessary to reapply the splints, to which was added a strap, that was attached to the apparatus so as to keep the lower fragment of the tibia in its position. A further difficulty existed in the burrowing of the pus, and a fresh abscess formed beneath the fracture of the tibia; when this was opened there was a free exit for the matter. From this time (the twenty-sixth day) the limb improved, and the patient herself was much better in health. At the end of six weeks she complained of pain along the outer side of the leg, near the broken fibula: it was attributed to the position, and the limb was therefore laid on its inner side. This gave relief, but there was soon a recurrence of the displacement of the foot outwards and backwards, and the fractures were not perfectly united, so that once more it was requisite to return to the apparatus for fractured fibula and to place the limb on its outer side: the foot was brought into its proper position by a strap passed beneath the sole of the foot, and attached to the leg-roller.

This treatment was pursued until the expiration of ten weeks. At this time the extensor tendons of the great toe sloughed; but as it was thought that now the union of the fractures must be perfect, the apparatus was removed: but the time had not even yet arrived, for again the old deformity was produced, and the splints were reapplied for the last time, and kept on for six weeks consecutively. The patient ultimately left the hospital after more than four months of treatment, able to use her limb, though the mobility was less than natural, and there was a certain amount of incurable deformity.

Fifth complication. Fracture with dislocation of the foot inwards.[1]—By dislocation of the foot inwards, I mean that form of displacement in which the astragalus assumes a position inferior and internal to the inner malleolus. This dislocation is so common, and so usually associated with fracture of the fibula (low down), that the latter is rarely found without the former, and indeed constitutes one of its most constant signs. Thus, the attention of authors being more attracted by the dislocation than the fracture, they have almost all omitted to notice the latter in their history of dislocations of the foot. I have already pointed out that the displacement in question is consequent on the prolonged operation of the causes which produced the fracture, or the effect of the action of the abductor muscles of the foot: it cannot, therefore, be regarded but in the light of a complication—a very common one it is true—of fracture of the fibula. The preceding cases afford many illustrations of this fact.

---

[1] [In other words, of the tibia outwards.—Tr.]

Sixth complication. Fracture with dislocation of the foot backwards.—This displacement is always referable to the action of the muscles, and not to the causes which produced the fracture: in this instance it is the gastrocnemius and soleus that are the agents; and the lower extremity of the inferior fragment of the fibula is carried back with the astragalus.

This dislocation, however, is only incomplete as long as the inner malleolus retains its integrity; but when this also is broken, the displacement may be as complete as in ordinary dislocation backwards.[1] The lengthening of the heel and the semicircular hollowing in this position, the osseous tumour on the instep, &c., mark the ordinary simple dislocation; but in the cases now under consideration, the outer malleolus, instead of forming a prominence parallel to the malleolus of the tibia, is carried backwards with the foot, to which it is attached by the lateral ligaments of the ankle-joint.

In these cases particularly, semiflexion of the limb is imperative: yet it is sometimes by no means easy to retain the reduced parts in their natural position, which I am disposed to attribute to the pulley-like tibial surface of the astragalus, which allows of this bone so readily gliding forwards, and especially backwards on the base of the tibia. I cite the following case in illustration.

CASE XIV. *Fracture of the fibula, with dislocation of the foot backwards.*—Pierre Froment, aged 33, was carrying a heavy weight on his back, and had his right foot in advance, when he by accident came violently in contact with a beam placed across his path. Under the dread of being precipitated forwards, he made a sudden effort to throw his body backwards, by which he lost his balance, and fell with the point of the left foot inclined successively inwards and forwards; and the whole superincumbent weight was thus thrown, first on the outer side, and then on the front of the ankle-joint. This occurred in 1817.

When the patient was admitted into the hospital, the relation of the base of the tibia to the foot was so altered, that as much of the latter was posterior as anterior to the axis of the former: the point of the foot was directed downwards and the heel elevated. On the instep was a large osseous prominence, over which the extensor tendons of the toes were stretched like tense cords. Behind the joint was a deep hollow, at the bottom of which the tendon achillis could be felt, forming a dense resisting semicircular cord, with its concavity backwards. The lower extremity of the fibula was also fractured; and the outer malleolus being held in contact with the heel, was directed nearly horizontally with its upper extremity towards the point of the foot. This last displacement was rendered more remarkable by the bold prominence of the inner malleolus, which retained its normal relation to the tibia. It was impossible to flex or extend the foot; and the slightest lateral movement was accompanied by abduction. The pain, swelling, tension, and heat were distressing, and rapidly increased.

---

[1] [The dislocation (of the base of the tibia) forwards, of most authors.—TR.]

The explanation of this case appeared to be, that the patient had first had the fibula fractured, and that the foot had been dislocated consecutively; the outer malleolus forsaking the former and accompanying the latter, whilst the tibia had in reality not moved its position.

It was clear that the proper course to pursue in this instance was, to reduce the displaced parts to their natural relations; and, for this purpose, I directed one assistant to fix the leg, and a second to make extension from the foot, whilst I placed myself on the outer side of the limb, and forced the heel forwards and the tibia backwards. The first attempt succeeded partially, and the second completed the reduction. I then placed the leg in my apparatus for fractured fibula, and laid it on its outer side, in a semiflexed position; ordering that the patient should be bled, and have an anodyne draught and low diet.

All the untoward symptoms rapidly subsided, and there was not a single drawback in the course of the treatment. In little more than a month the patient was able to walk, and soon afterwards left the hospital quite well.

Seventh complication. Fracture, with displacement of the foot outwards.—By the *dislocation* of the foot *outwards*, I mean that in which the astragalus is carried to the side of and beneath the outer malleolus, whilst the outer border of the foot is directed downwards, the plantar surface inwards, and the inner margin upwards. The inner malleolus thus sinks out of sight between the foot and leg, lying at the bottom of an angular depression; whilst the outer malleolus, in company with the astragalus, forms a rounded prominence externally. The whole deformity presents very much the appearance of a congenital club-foot.

This displacement is one of the most rare and difficult of explanation: indeed, the only answers to the various questions on the subject which suggest themselves, are to be furnished by a consideration of the opposing forces tending to produce dislocation in one or other direction.

When in a state of integrity the ankle-joint is kept in a condition of equilibrium by the antagonizing muscles and malleoli with their ligaments. Yet these forces are not exactly equally balanced on the two sides: for the adductors are the more powerful muscles, though the abductors act at a greater advantage. The external malleolus again, from its greater length, offers an insuperable obstacle to the foot being thrown outwards, as long as it remains entire.

But supposing the outer malleolus to be broken, then the foot must be carried outwards by the abductors, which have the advantage over their antagonists, not so much because they are more numerous or stronger, as on account of their insertion into the arm of a longer lever. For the same reason, if both malleoli were fractured at the same height, the preponderance of power would still be with the abductors, and the outer border of the foot would be thrown outwards, whilst the astragalus would be directed inwards; that is, if there were no interference on the part of the extensors of the ankle-joint, in which case the displacement would be backwards and outwards.

One would, therefore, be led to conclude, that when the tibia alone has been broken at its lower part, the foot ought to be thrown inwards; yet experience proves the contrary: and I shall presently show that almost all fractures of the lower extremity of the tibia are followed by slight displacement of the astragalus inwards, which is certainly due to the excess of power evinced by the abductors, which appears to require for its manifestation, nothing but the solution of continuity of either tibia or fibula indifferently.

Displacement of the astragalus outwards and of the foot inwards can, therefore, only spring from some peculiar and very rare disposition of parts; such as obliquity in the fracture of the tibia, and more or less resistance on the part of the lower fragment of the fibula. This obliquity not only occasions overlapping of the fractured extremities of bone, but likewise determines the direction of the displacement, and influences the muscles which are the agents, as well as the means resorted to for its relief. When the fracture of the tibia is obliquely from above, downwards and outwards, and the lower fragment of the fibula still affords support and resistance to the outer side of the joint, the foot must then yield by inversion, as illustrated in the following case.

Case XV. *Oblique fracture of the tibia outwards and downwards; with fracture of the fibula, and displacement of the foot inwards and astragalus outwards.*—Miss M., aged above 50, of spare habit and nervous temperament, fell out of a first-story window on to the pavement, the principal shock being received on the inner border of the foot and corresponding malleolus of the right side. When raised up, she complained of acute pain in the ankle-joint, yet there was no evidence of any displacement: but when carried into her room she attempted to stand on the injured limb, and then experienced an immediate paroxysm of renewed pain, and again fell on her right side. This time the foot was very much inverted.

When called in, I found the inner side of the leg and foot hollowed, and the outer side rounded in a semicircular form. In the former position I could feel a prominent fragment of bone connected with the inner malleolus; and in the latter it was evident that the outer malleolus was broken to pieces, whilst the astragalus projected beneath the skin in front of it. The fracture of the tibia was obliquely downwards and outwards, and about an inch and a half above that of the fibula.

I reduced the parts readily, but found it difficult to maintain them in their normal relations, though flexion of the knee considerably aided in accomplishing this object. As the action of the adductors appeared to be the cause of this difficulty, I determined on applying my apparatus for fractured fibula, taking the precaution, however, of placing the splint by which I fixed the foot on the outer, instead of on the inner, side of the leg. The limb was then laid, semiflexed, on its outer side, and an evaporating lotion applied to the ankle-joint.

This patient went on very well till the sixth day, when the apparatus was unfastened, and the original displacement again took place in consequence of some imprudent attempt to move the leg. The fracture and dislocation being again reduced, and the apparatus reapplied, it was worn for seven weeks, and then left off. There was at that time some little riding of the tibial fracture, and the astragalus and outer malleolus projected a little outwards. She was kept at rest three weeks longer, and then permitted to walk, having the ankle well supported on each side, and thus gradually recovered the use of the limb.

Eighth complication. Dislocation of the foot outwards and upwards.—This form of displacement is so rare that I have only seen it once in nearly two hundred cases of fractured fibula which have fallen under my observation in the last fifteen years. It involves not only fracture of the fibula, but also laceration of the strong tibio-peroneal ligaments, which generally resist a force to which the osseous tissue itself yields. The following is the remarkable case to which I refer.

CASE XVI. *Fracture of the fibula and rupture of ligaments, with dislocation of the foot outwards and upwards.*—C. N. Guillemain, a joiner, aged 54, of sanguine temperament, was coming half-drunk out of a pot-house, for the purpose of making water, when, reeling along in a hurried manner, he came to an inclined and slippery piece of ground, where he fell, his right leg being extended outwards from the body, the weight of which it had to sustain together with the superadded momentum of the fall. Being unable to walk, he was immediately conveyed to the Hôtel-Dieu. This occurred in the winter of 1816.

When admitted, the presence of the usual signs indicating fractured fibula low down were readily detected: but what most attracted attention was the shortness of the leg, together with the almost doubled interval comprised between the malleoli, and the prolongation of the tibia downwards to a level with the sole of the foot: the astragalus and outer malleolus, with the whole foot, were drawn up on the outer side of the tibia, two inches above their normal position. All these signs left no doubt that the ligaments connecting the tibia and fibula were torn through, and that the foot was dislocated outwards and upwards, carrying with it the outer malleolus.

The swelling, tension, and pain momentarily increasing, it was necessary at once to reduce the parts; and this was satisfactorily accomplished after the patient had been bled. The foot and leg then resumed their natural form and direction, and my apparatus for fractured fibula was forthwith applied, and an evaporating lotion laid over the joint.

On the following day the apparatus was removed with a view to re-apply it, and in consequence of an involuntary contraction of the muscles, the parts were again thrown out of place: the reduction was more readily effected this time by distracting the attention of the patient, and the apparatus was again adjusted: a second bleeding was ordered, and low diet prescribed.

On the third day the tension, swelling, and pain had nearly subsided; and from this time, strange to say, considering the serious mischief which must have existed, the case proceeded as if it had been one of simple fracture; so that on the thirty-sixth day the patient began to walk with crutches, and there was not the slightest irregularity in the form of the injured limb. He speedily regained his strength; and when seen six months afterwards, he retained only the recollection of the accident, without any of the consequences which it originally threatened.

Ninth complication. Comminuted fracture.—This complication is generally the effect of some crushing accident, such as the passage of a carriage-wheel over the lower and outer part of the leg. The displacement of the fragments in this form of fracture may produce irritation, or cause positive injury to the soft parts, such as the nerves, tendons, fascia, or skin; and as sequences, pain, inflammation, abscess, sloughing, or even tetanus; by which the life of the patient is endangered, and, at the least, the treatment is prolonged and the issue unsatisfactory.

The history of the accident will lead the practitioner to suspect the probability of there being a comminuted fracture of the lower extremity of the fibula: but the presence of the ordinary signs of this complication are generally sufficiently palpable to the sight and touch.

The injury in question may, however, give rise to none of the serious consequences above enumerated, when the fragments are not displaced, but retain their natural relation to each other: indeed, in such case, the progress and completion of the cure differ very little, if at all, from that of a simple fracture. The object of the surgeon should be, therefore, to restore the fragments, if displaced, as soon as possible to their normal relations; which may frequently be done by prompt and decided measures: and of course the proper means must be resorted to for preserving them in this condition.

Tenth complication. Fractures, with internal derangement of parts.—In fractures generally, the lesion to the neighbouring textures is frequently such as to astonish one at their perfect and speedy restoration: but in fractures of the lower extremity of the fibula, the nature and extent of the mischief is often such as to lead the practitioner to question the possibility of its ever being remedied. The following may serve as a brief summary of the complications alluded to.

As regards the *bones*, the fibula alone, or with it the tibia, may be fractured, the former at any part of its lower third even to the point of the malleolus, and the latter in like manner; either bone may be broken transversely, obliquely, or longitudinally, at one point or at several, with or without displacement; and there may or may not be spicula, which, when they exist, may be pointed, cutting, in place, or penetrating the surrounding soft parts. The *ankle-joint* may be closed or laid open, accordingly as the fibula is broken very low down or not, or as the tibia is involved or retains its integrity, &c. When this joint is open, there may be blood coagulated or mixed with synovia, within the synovial capsule, the interior of which may or may not communicate with the external air, by laceration of the integuments. As to the *soft parts*, all the ligaments may be more or less torn, though the internal lateral most frequently suffers, as when the astragalus is much driven inwards: the tibio-peroneal ligaments yield when the fibula is tilted in such way as to allow the astragalus to take up a position on the outer side of the tibia: the external lateral ligaments are very rarely ruptured. The sheaths of the abductor and adductor tendons are seen torn open in cases where decided dislocation has occurred; and the tendons themselves and neighbouring nerves are found stretched, compressed, displaced, and even partially or completely divided by the oblique fragments belonging usually to the tibia. The arteries and veins, especially the great saphena, may be injured or lacerated, and surrounded by extravasated blood: and lastly, the areolar tissue of the whole limb, whether subcutaneous or interstitial, or surrounding the vessels, nerves, &c., may be more or less distended by bloody serum, or yet more frequently gorged with extravasated blood. Such is a cursory view of the accompanying and consequent mischief in cases of fractured fibula and the displacements which result therefrom. They are such as render the accident formidable indeed in the hands of the unskilful, but at the same time such as experience proves may be repaired by a timely recourse to the resources which art and science have placed at our disposal.

Eleventh complication. Fracture, with extravasation of blood.—This common occurrence in fracture may be influenced by many modifying circumstances. When it consists in a general infiltration of the subcutaneous areolar tissue, it is usually readily absorbed, though this is not invariably the case. But if the blood be extravasated, that is, poured out into the lacerated areolar tissue as into a large sac, surrounding perhaps the fracture or the joint, or even penetrating into the latter, then its presence may entail serious mischief. But even in this case the consequences are not so important when the skin is unbroken, as when it is badly contused or lacerated: in the former condition, the quantity of effused blood, though great, may still be absorbed, but in the latter, the access of air will produce decomposition, followed by inflammation and profuse suppuration with all their serious consequences: and the same result may ensue where the fracture remains unreduced, from the irritation caused by the sharp fragments in the surrounding soft parts. The presence of extravasated blood, therefore, so far from constituting an objection to the reduction of a fracture, renders it still more imperative. But the favorable issue of the case by no means depends on this alone; for the practitioner must exercise his discretion as to the employment of resolvent or stimulant applications, accordingly as the skin and surrounding textures appear sluggish or disposed to inflammation: and if an appropriate treatment be adopted and preserved in, even large collections of effused blood, may thus be absorbed. If, however, with a view to hasten the cure, the surgeon should be so imprudent as to lay the sac open, all the disastrous consequences, which I have just enumerated as the sequelæ of accidental communication with the external air, are likely to ensue, terminating in low fever, sweats, and diarrhœa, which sweep off so many patients. Of the preceding cases, Nos. VII and X furnish instances of a satisfactory termination, where extravasated blood was evacuated or absorbed.

Twelfth complication. Compound fracture.—The skin is unfortunately often wounded in cases of fracture of the fibula; and this may be either the immediate consequence of the fracture and produced by the same cause, or it may not occur until some time afterwards: in the former case it results from the protrusion of the broken end of the bone, and may take place either internally on a level with the inner malleolus (the more frequent), or externally opposite the seat of fracture in the fibula. These irregular, lacerated, or contused wounds sometimes closely grasp the protruding bone, at others they allow the infiltrated blood to ooze, or shreds of disorganized textures to escape. When the wound is consecutive, it is consequent on the separation of slough, or on inflammation; or it may constitute a part of a natural process by which extravasated blood or disorganized textures are, as foreign bodies, got rid of.

These openings are among the most serious complications of fractures generally, and therefore of the fibula in particular, whether we view them as indicating the amount of mischief within, or in their direct influence on the issue of cases. The most to be dreaded are those accompanying the injury, which generally entail protracted suppuration; but such as succeed inflammation, the separation of sloughs, or abscess, are generally less formidable.

Although then it is most important to guard scrupulously against the conversion of a simple into a compound fracture, yet, when this cannot be obviated, it is desirable at once to enlarge such communication to allow of the free exit of matter, which, if pent up when once the air is admitted, will give rise to further disorganization, necrosis, and a multitude of evil consequences. Many cases in this paper illustrate the principles I have been here propounding.

Thirteenth complication. Fracture, with tumefaction, tension, and strangulation.—These conditions, may arise from two causes which it is necessary to distinguish in practice. They may depend, in the first instance, on a temporary congestion or determination of blood to the injured soft parts; and thus, not partaking of the character of inflammation, these symptoms may disappear as rapidly as they supervened, without exercising any influence on the progress or complexion of the case. But, at a later period, when they are accompanied by heat, redness, and local and constitutional disturbance, there can be no doubt about the presence of inflammatory action.

The first-mentioned form of swelling and tension makes its appearance very shortly after the fracture has occurred, and these symptoms vary in amount in proportion to the extent of the injury: in a few hours they may acquire an alarming degree of intensity, completely obliterating the form of the joint and outline of the bones in the neighbourhood. The parts, in such case, become hard and shining; vesicles filled with reddish or brownish serosity form on the surface, and the limb becomes cold, livid, and insensible. Nevertheless, even yet this urgent state of things may be remedied by speedy reduction of the displaced bones. But, if not relieved, the stage of strangulation succeeds which terminates in partial or complete gangrene of the limb.

In the treatment of the above condition, the first step to be taken is the reduction of the fracture or dislocation. Bleeding, leeches, anodyne applications may, it is true, aid in preventing gangrene; but then there is the inflammation to combat, which alone may entail the greatest risk to the patient. One of the most noxious remedies that can be employed in these cases is that of emollient poultices, which, instead of facilitating the resolution of this distended condition of the vessels, favours by the warmth and moisture afforded, the tendency to increasing swelling; and though the character of the tumefaction may be a little changed, the danger is in no way diminished.[1]

Fourteenth complication. Fracture, with inflammation, suppuration, &c.—These sequences of the consecutive tension I have been speaking of, are especially serious in cases of fracture of the fibula in its lower third, on account of the nature of the surrounding textures, which are principally vascular, nervous, and fibrous; all bound down by a very thick resisting fascia. These symptoms and the attendant suffering are rarely relieved until the collected pus has a free exit.

A great many circumstances may operate as exciting causes of this inflammation, the principal of which is the displacement of the foot or of the broken ends of the bone, or the irritation occasioned by spicula becoming included in the neighbouring soft parts. The excessive action thus set up may yield by resolution to proper treatment and the efforts of nature: but if allowed to run its course, without amendment, the issue is loss of vitality, affecting sometimes only the skin, at others extending to the nerves, tendons, and ligaments; and even the entire foot is occasionally involved in this destructive process. There is, however, another termination to this threatening condition, namely, by diffuse suppuration, in which case the evacuation of the matter is essential for the relief of the symptoms of strangulation.

Sometimes the inflammatory action will assume the more treacherous form of phlegmonous erysipelas, and the attendant symptoms of pain, tension, heat, &c., are mild in character, and do not supervene until after the lapse of some days. Thus a little œdema and erysipelatous redness first attract attention without awakening alarm; but this proceeds, until that state of the surface which at first pitted on pressure, is superseded by the hot and tense condition already described. The constitution then sympathises actively, and the local disorder passes into the further stage of diffuse suppuration, partial sloughing, and more or less disorganization of the soft parts. Under this and the attendant fever and diarrhœa the patient usually sinks at a period varying according to his age and the power of his constitution. An examination of the seat of injury always proves that the mischief originated internally, and was thus propagated to the surrounding parts.[1] I could cite many instances of recovery from the state I have been describing, but I prefer narrating, as more instructive, a case which terminated fatally.

---

[1] [This remark should be received with some reserve by practitioners.—Tr.]

CASE XVII. *Fracture of the fibula and inner malleolus, followed by erysipelas and death.*—Jean Lamassé, aged 68, a coachman, worn out by years, toil, and misery, fell from his box with his right leg bent up under him and forcibly adducted. He succeeded in rising, but again fell when he attempted to walk, and struck his head against the ground. He was taken to the Hôtel-Dieu seven hours after the accident.

He was then remarkably apathetic and insensible. The right ankle was swollen and distorted, the foot being everted so that its inner surface faced downwards; and the axis of the leg fell on the inner side of the foot. The inner malleolus was torn from its connexion to the shaft of the tibia, which latter projected through the skin; and the fibula was broken an inch and a half from its lower extremity.

The fracture was reduced, and the ordinary apparatus for fracture of the leg applied: the fibula was thus pretty well retained in position; but I found on the following day that the tibia still formed a prominence opposite the inner malleolus: the patient continued in the same sleepy, indifferent state to all around him. The apparatus I employ for fractured fibula was applied on the third day. This the patient removed during the following night: and was soon afterwards violently delirious.

The leg now became red and swollen; and on the sixth day the skin changed to a reddish-brown, and became thinned at two points, from which some fetid pus, mingled with gas, was evacuated. There was no attempt on the part of the system to rally: narcotic injections and vinous lemonade were administered,[1] but without benefit; and the patient sank, in a state of collapse, ten days after the accident.

---

[1] [It may be remarked that, in London practice at least, the previous habits and state of health of the patient have an immense influence on the development or non-production of the above condition; a trifling accident producing in one individual, that which the most serious and complicated mischief will not give rise to in another. It is this consideration which must often exercise an important influence in determining for the surgeon whether he will attempt to save or sacrifice a limb.—TR.]

Autopsy.—A great deal of blood was found extravasated around the ankle-joint; and the thecæ of the extensor tendons of the foot and of the tibiales were thus distended. The internal saphena vein was red, swollen, and inflamed for three or four inches of its extent, where it was filled with pretty thick sanious pus. The fracture of the fibula was transverse, and the broken ends were in apposition: the external lateral ligaments were entire. The fragment of the inner malleolus was isolated, with the exception of being connected by a part of the internal lateral ligament to the calx and astragalus. The corresponding portion of the base of the tibia was irregular and its spongy texture was exposed: the articular surface of this bone looked downwards and outwards. By fixing the tibia and moving the foot from side to side, I could imitate the action of the peronei muscles in producing lateral displacement, and could also show how the reduction might be effected. Great, however, as was the local mischief immediately resulting from the accident, it was not this but the consecutive phlegmonous erysipelas which destroyed the patient: for I have seen many instances of injury quite as extensive which have terminated favorably.[2]

Fifteenth complication. Fracture, with pain, spasm, and tetanus.—The pain which I now refer to is not of that acute, sudden, and transient character which is the immediate consequence of the accident; nor do I speak of circumscribed pain confined to the seat of injury, and excited by drawing the finger along the bone; but of that consecutive, permanent form, which is caused by displacement of the fractured ends of the bone, and by laceration or other injury of the surrounding soft parts; which inflammation, swelling, tension, and compression increase; which is accompanied by sleeplessness, fever, frequent and involuntary twitching and spasm of the muscles, causing renewed displacement of the fracture and fresh injury to the soft parts; and terminating, if unarrested, in

[1] [Nothing further is said about the treatment, or what support was given: neither are we told what were the previous habits of the patient.—Tr.]

[2] [Few of which, we apprehend, were in patients approaching seventy.—Tr.]

tetanus. This is a condition which anodynes may palliate; and large doses of narcotics may even completely lull the pain: but the security thereby inspired is fatal, in as much as it is the effects alone that are masked, whilst the exciting cause remains untouched, unameliorated. Under these circumstances I have seen gangrene supervene, without being ushered in with the usual premonitory pain, in consequence of narcotics having been too freely administered. As the displacement of the fragments of the broken bone is the usual source of this mischief, the surest way of remedying or preventing it is to reduce the parts to their normal position. I do not mean to say that tetanus, when once fairly established, can be thus relieved: all remedies are then vain, and even amputation rarely proves productive of any benefit. The following is the only disastrous case of the sort, which has come under my notice, after fracture of the fibula.

CASE XVIII. *Fracture of the fibula and inner malleolus, followed by tetanus and death.*—Madame L., a lady scarcely in the prime of life, who had been suffering much from a domestic trial which weighed upon her spirits, was returning home (in the country on the banks of the Seine), when her husband was nearly crushed between a post and the wheel of a small carriage she was driving. In a moment of terror she drew up the reins so suddenly and violently, that the horse backed towards the river, and this fresh alarm prompted her to throw herself from the carriage: she fell first on the outer border of the left foot, where she felt acute pain, and then lay extended on the bank of the river.

The foot was so much inverted and the bones of the leg so much forced outwards, that the extent of injury sustained at once became apparent. The surgeon who was summoned detected successively, displacement of the foot in such direction that the plantar surface was directed inwards and the astragalus outwards; a broad and deep wound on the outer side of ankle-joint, between the peronei and the common extensor of the toes; and both bones projecting from this wound, the fibula being fractured about two inches from its extremity, and the tibia at the base of the inner malleolus.

The pain Madame L. suffered was excruciating. Both fractures and dislocation were reduced, and the apparatus of Scultetus applied, the limb being placed on a pillow with the knee extended. An anodyne was administered to aid in mitigating the suffering which the reduction had not assuaged.

On the second day when the apparatus was loosened the dislocation appeared reduced, but there was no alleviation of the pain, which was now accompanied by continual spasms and sleeplessness. Amputation was proposed, but rejected by the relatives: the same apparatus was therefore reapplied, the patient was bled, and anodyne draughts were ordered. The two following days these symptoms continued unrelieved, the suffering occasioned by the cramp frequently eliciting groans and screams from the patient. When the apparatus was removed, the whole circumference of the joint presented an elastic, shining swelling, and fetid pus and synovia exuded from the wound. Up to the eighth day the preceding symptoms became more aggravated, and the patient's nervous susceptibility was most distressing: music alone possessed the magic power of tranquillizing the frame and bringing relief to her suffering. The heat was excessive, so that no covering could be borne; but such air as could be obtained was allowed free access to the room.

On the evening of the ninth day the wind changed and blew from the north; and then the symptoms of trismus, rapidly succeeded by those of tetanus, set in; with all the painful accompaniments of hurried respiration, rapid pulse, cold sweats, &c. Large doses of laudanum were given without any benefit; and on the following day the whole body was affected with the tetanic symptoms, opisthotonos being especially severe. The abdomen, however, remained soft, and the natural evacuations were not arrested. More opium was given, but without relief.

On the thirteenth day the symptoms continued unabated; a large abscess on the leg was then opened, from which a quantity of matter flowed: the opium was still further increased, and given both by mouth and in the form of enema.

It is needless to trace the remaining details of this case further than to say that the treatment adopted had no influence on the disease. On the seventeenth day, as a last resource, the leg was amputated: the muscles appeared hard and crisp, and assumed a black appearance, as if charred, after exposure to the air: the larger vessels alone bled. On the following day the symptoms were still unabated, till towards evening, when there was a delusive lull, which proved, however, but the precursor of death. Her husband sank under the affliction, and died a few days afterwards of a broken heart.

Associated with this distressing case, there is one interesting circumstance worthy of remark, and which occasioned not a little surprise to those who witnessed the severe tetanic sufferings of the unhappy patient: it was that she was four months advanced in the family-way, and yet never once evinced a single symptom of miscarriage, the womb remaining entirely unaffected by a disease which seemed to have included in its grasp almost every other organ. On examining the ankle-joint of the amputated limb, the external wound was found to communicate with the articulation, the surfaces of which were denuded of their cartilage; the ligaments were torn, the tendons displaced, and the filaments of the musculo-cutaneous nerve lacerated and put on the stretch; whilst the areolar tissue was distended with sanious pus.

Sixteenth complication. Nervous delirium.—This subject I consider of sufficient importance to demand a separate notice. I shall, therefore, defer its consideration to a more convenient opportunity.

Seventeenth complication. Necrosis.—This sequence of fracture is attributable to various causes. The most common of these is exposure of the bone to the influence of the external air, by the destruction or perforation of the soft parts: a second, and almost equally frequent cause is, inflammation and suppuration involving the periosteum. The latter of these causes may operate in two ways; either by detaching from their cellular or filamentous connexions, and thus isolating, small fragments of bone in a comminuted fracture, or by destroying the periosteum and thus cutting off their vascular supply. These fragments or splinters, when cast off, in some instances exhibit traces of having been subjected to a vital process, by the partially eroded appearance they present; whereas in others, their sharp margins and angles prove them to have been entirely isolated at an early period, if not at the time of the accident.

This form of necrosis much more rarely affects the extremities than the shaft of a long bone, on account of the softer texture and greater vascularity of the former. The reason why the fibula, when fractured, is infrequently affected with necrosis is, that this bone is so surrounded by the muscles (above), that the spicula are nourished by their vessels, and thus the *provisional callus* is first formed, which subsequently becomes identified with the substance of the bone.

But, though necrosis of the bone is not a common occurrence in these fractures of the fibula, sloughing of the tendons is by no means rare; a circumstance which seems attributable to their number and position, as it is almost always produced by their being raised and injured by the sharp or cutting fragments of the bone at the seat of fracture, or else it is the consequence of inflammation and suppuration. The tibialis anticus suffers when the tibia is broken; and when the peronei are involved, it is in cases of fracture of the fibula. This loss of vitality is not an immediate result of the injury inflicted; but, after a time, pain, redness, heat, and swelling, accompanied by tension and followed by obscure fluctuation, manifest themselves along the course of the tendons; the skin then gradually yields and gives exit to the accumulated matter, and the dead parts are thrown off in shreds: after this the wound soon heals, but leaves the foot curtailed of its natural movements, according to the extent of the destructive process. The only means of preventing this mischief are, to reduce the fracture, and prevent the accumulation of pus.

Eighteenth and last complication. Adynamic affections.—A frequent accompaniment of inflammatory diseases generally, and of fractures of the fibula in particular when succeeded by inflammation, is an adynamic affection, which may assume two very different phases, requiring careful discrimination; as the treatment required varies materially, accordingly as this state of the system is true and essential, or false and symptomatic. In the former condition, the body, limbs, and features are motionless and without expression, the eyes lustreless and tearful, the skin cold, clammy, and cadaverous, and the tongue pale and covered with a viscid, dark coat; the evacuations are fetid, and there is general apathy, insensibility, and prostration of the vital powers.

In that which may be called the false adynamic state, the patient is restless, and the features expressive of anxiety and general uneasiness; the face is flushed, the eye eager, and the skin hot; the pulse may be small, but is always contracted, frequent, and even hard; the tongue is dry, and brown in the centre with bright red edges, and the thirst intense: there is also a continual alternation of prostration and reaction, a mingled sensation of shivering and heat, of strength and weakness, which altogether proclaim a morbid condition of the system, that at once excites and wears, without quenching, the vital powers.

These are serious complications which materially enhance the danger of the primary mischief: yet, in the abstract, they might be dealt with satisfactorily, by treatment appropriate to each form of the affection, were it not for the coincidence, in itself easy of comprehension, that the subjects of these attacks are almost always persons exhausted by low spirits, toil, misery, or antecedent disease. It is this which renders the conditions I have been describing so frequently fatal; especially as the surgeon has to cope with two opposing forces at one and the same time, the one inflammatory and the other asthenic. The prospect of success is, however, greater where the prostration is the consequence of suppuration, for then tonics may be freely administered. When inflammation, without suppurative action, exists, the treatment must be gently antiphlogistic, as by small bloodlettings, leeches, and cooling drinks.

These are the complications which have carried off the very few patients whom I have lost after fracture of the fibula.

TREATMENT.[1]

The treatment of fractured fibula with dislocation of the foot is surrounded by difficulties, and demands much discrimination, and the adoption of a method, founded on certain fixed principles. These principles are to be gathered from a careful study of the relative anatomy and properties of the constituent parts of the leg, and of the ankle-joint in particular; as well as a just appreciation of the mechanical causes of the injuries referred to. That the treatment hitherto adopted in these cases has proved inefficient, a brief review of the plans heretofore employed will suffice to demonstrate.

---

[1] [The historical division of this part of the subject has been abridged.—Tr.]

We have already seen that the father of medicine, in the book *περὶ αρθρων*, advises no treatment, and that from motives which would lead one to doubt its authenticity. J. L. Petit recommends, it is true, the reduction of the dislocation, but makes little mention of that which is most difficult, namely, keeping the parts in their proper position. Lecat's advice was to keep the two bones of the leg separate by a compress; to which Bromfield added the further improvement of a pad on the outer malleolus, so as to tilt the lower fragment of the fibula outwards. Pott insisted on semiflexion of the limb; and Pouteau, whilst he fully appreciated the difficulties and risk of deformity in these cases, said not one word about the means of meeting the one and obviating the other. Desault's treatment, again, appeared successful in two cases, but the clumsiness of his apparatus, and the tightness of his bandaging are not such as to tempt imitation: and the long external splint of Richerand and Castella was found insufficient to preserve the parts in position and prevent further displacement. Thus, though Pott deserves the credit of having pointed out the best method of reducing these fractures; and other of the authors mentioned have, to a certain extent, attempted to meet the difficulties of consecutive displacement, it appears that none have succeeded in accomplishing this object: some cases will illustrate this fact.

Case XIX.—M. J. F. P. Castella, whilst a student at Paris, was running a race with a companion, when they both came unexpectedly to the edge of a precipice, down which they were forced to jump more than thirty feet: his companion got off with a severe sprain; but M. Castella had his fibula fractured, his inner malleolus torn from the tibia, and the foot dislocated inwards and backwards, so that its plantar surface looked outwards, and the lower extremity of the tibia formed a prominence in front.[1]

He had the presence of mind to reduce the parts and bind the joint with a handkerchief, and was thus conveyed to Paris; considerable swelling in the mean time supervened, especially over the inner malleolus. The ordinary fracture apparatus was then applied to the leg, the only peculiarity in its adaptation being, that the lateral splints were put on so as to extend beyond the sole of the foot, and were very tightly bound around the ankle. Great swelling and constitutional disturbance ensued, and subsequently erysipelas made its appearance. These symptoms gradually yielded to active antiphlogistic treatment, and the same plan of treating the fracture was persevered in, although in a fortnight it became evident that there was depression of the fibula, accompanied by prominence of the outer malleolus.

---

[1] The author of this case (the patient) thought that this prominence was formed by the pulley of the astragalus: but as no mention is made of the direction in which the foot was elongated, and it has never occurred to me to witness a dislocation of the foot forwards accompanying fracture of the fibula and extremity of the tibia, I have been led to adopt the statement in the text.

At the end of six weeks the apparatus was removed and replaced by a figure-of-eight bandage: but the two malleoli continued prominent, whilst the lower extremity of the shaft of the fibula was close to the tibia; and the various motions of the ankle-joint were very limited: the patient also suffered considerably in attempting to walk. Exercise, baths, liniments, &c., were had recourse to, yet the progress of the case was very slow, and at the end of eighteen months, the above-mentioned deformity remained, and the joint was far from strong, or free from pain under exercise or after standing for some time.

Such was the termination of a comparatively simple case, in the hands of one of the first surgeons in Paris: the result, however, was satisfactory compared with that of some on record, of which the following may serve as an example.

Case XX. *Fracture of both bones of the leg, with dislocation of the foot inwards.*—Jean-Baptiste Lefebvre, was at work at Guadaloupe, in 1773, when he was thrown down a height of twelve feet by a mass of earth falling in upon him. When exhumed, it was found that his right leg was badly bruised, and that his left was broken low down, the foot being, at the same time, dislocated inwards, and twisted so that the plantar surface faced outwards: a considerable quantity of blood was extravasated around the joint. The patient was taken to an hospital, where the fracture and dislocation were reduced, and the limb was put up in the ordinary way. Being young and robust, he was bled several times and put on a low diet.

The apparatus was not removed for a week, and then the foot was found displaced and twisted outwards: there was also a large abscess opposite the inner malleolus, which was opened and stuffed with charpie. The fracture apparatus was replaced by a simple roller, with side splints and a wooden foot-piece. From this time the poor fellow passed through the greatest suffering in consequence of the entire displacement of the injured bones and joint. Swelling, inflammation, sloughing, necrosis followed each other, but his youth and good constitution ultimately triumphed, and he began to recover; and in eighteen months after the accident, he quitted the hospital. But even then his suffering did not cease, for the wounds broke out afresh, and his limb only began to gain strength and flesh after the expiration of another half year: he at that time began to walk; and has continued to do so with difficulty and pain ever since.

After the interval of forty-two years this man came under my notice, and it is to the condition of the injured limb, at that time, that I wish to direct attention; as it afforded an excellent illustration of the characteristic features of the accident which had been so sadly maltreated. The maimed leg was shorter than the opposite, and its axis was entirely internal to the foot; the tibia becoming more and more prominent towards its lower extremity, where the strain upon the internal lateral ligaments must have been very great. The axis of the fibula was the same as that of the tibia, as low down as the seat of fracture, that is, to within an inch and a half of the ankle-joint; but from this point downwards its direction was obliquely outwards. The foot was not only thrown outwards, external to the axis of the leg, but was also twisted on itself, so that the plantar surface and external border were severally directed outwards and upwards: and this oblique bearing did not commence at the ankle-joint as might have been expected, but from the point where the fractures of both bones had existed. The seat of fracture on the tibial side was marked by an obtuse and salient angle, whereas that on the fibula side was indicated by an obtuse and re-entrant angle.

In standing or walking, the weight of the body was transmitted to the ground through the inner border of the foot, whilst the heel and outer margin were drawn upwards and outwards by the gastrocnemii and peronei muscles: there was in consequence great stress upon the inner malleolus and internal lateral ligament; and the latter seemed much strengthened by an accumulation of fibrous tissue, to supply the deficiency in the opposing force of the adductors. Thus, the centre of gravity had shifted its position as regards the injured limb; and walking, or even standing for any length of time was thereby rendered difficult and painful: for it was impracticable for him to rest on the sole of the injured foot, without throwing his weight so entirely over to the same side, that he lost his equilibrium and was unable to walk in this way. The almost entire loss of mobility at the ankle-joint further increased the difficulty of progression: and the unfortunate limb was, moreover, the seat of varices, swelling, and erythematous eruption, which at times quite precluded his walking at all.

Such then is the result of insufficient surgical aid in a case of simple, though in a measure complicated, fracture of the leg. But in both the instances I have just quoted the limbs were saved: in how many have they been sacrificed, or life itself lost, where appropriate treatment would have effected a safe and satisfactory cure!

I have already had occasion to direct attention to two cases (XVII and XVIII), in which the issue was unfortunate: and in turning to them it will be remarked that the ordinary, instead of my special, apparatus for fracture of the leg was employed, in one instance for a short time, and in the other during the whole course of the treatment. I shall, therefore, not longer dwell on these disastrous consequences of mal-treatment, but prefer devoting the remainder of this paper to the discussion of appropriate remedies, by which such results may be obviated.

Curative indications.—A due consideration of the indications to be fulfilled is the proper mode of arriving at the appropriate treatment in all diseases. Thus, in fractures of the fibula, those which occur at any point above three inches from its lower extremity are not liable to displacement, and only require rest to effect a cure, as illustrated in Case III. Where the seat of fracture is below the above-mentioned limit, rest is still more imperative, on account of the risk of displacement of the fractured ends: Case VIII exemplifies this fact. When simple dislocation of the foot accompanies this fracture, the parts should be reduced as soon as possible; and when further complications exist, this curative indication requires, *à fortiori,* at least as prompt attention.

Some persons think it requisite to wait until the swelling and inflammation have subsided; and a most vicious practice this is, in as much as the symptoms and the attendant suffering are in a great measure dependent on the displacement; whence it necessarily follows that the readiest and safest method of relieving the patient is to restore the parts to their normal position, for the longer this is deferred the greater is the attendant mischief and probable risk.

To temporize in these cases gives rise to two evil consequences: in the first place it exposes the patient to excessive suffering, violent spasms, and the risk of tetanus; and in the second, it is productive of swelling, tension, severe inflammation, and their probable consequences, profuse suppuration, gangrene, and death: or, if they escape the last alternative, the only other one is, certain and permanent deformity. Indeed, it may be affirmed, as an axiom, that fracture of the fibula which has been left unreduced until the inflammation has subsided becomes irreducible, at any rate by ordinary means. I will exemplify this by a case.

CASE XXI. *Deferred reduction of fracture, and its disastrous consequences.*—A servant of Mr. T., having climbed a pear-tree, the branch on which he stood gave way, and he fell on the inner border of the right foot: severe pain was felt at the lower part of the leg and in the ankle, and great swelling almost immediately succeeded. A country doctor, who thought there was nothing but a sprain, contented himself with the application of some lotions and a bleeding. Violent fever supervened, with spasms and delirium, and a surgeon of ability was called in on the fifth day. He detected the existence of fracture of the fibula, with dislocation of the foot outwards: yet he proposed no modification of the treatment, but merely directed his attention to such superficial local symptoms as from time to time declared themselves.

The progress of the case was from bad to worse, until the abundant suppuration and tendency to gangrene threatened the patient's life, and then I was called in. Struck with the amount of displacement, symptomatic of the complicated injury, I proposed attempting its reduction: but my advice was not listened to for various silly reasons and from groundless fears, and I accordingly left them to pursue the same course of treatment. Sloughs separated from either side of the ankle, and diffuse suppuration continued.

These symptoms diminishing, it was thought proper to attempt the reduction at the end of three weeks. The extension and counter-extension employed were very painful, and almost without effect; and then the limb was put up in the ordinary apparatus for fracture of the leg: but so abortive did these measures prove, that the splints were abandoned a fortnight afterwards. The patient ultimately recovered, after running the greatest risk from a subsequent attack of erysipelas, from bilious fever, excessive suppuration and its attendant constitutional disturbance; but he retained all the deformity described in Case XX.

Concerning reduction.—The displacement of the fractured ends of a broken bone must result, either from the force by which the injury was produced, or from the action of neighbouring muscles. The operation of the former cause is limited to the moment of the receipt of the injury; whereas that of the latter is perpetuated as long as the muscles are stimulated to contract. It is this active obstacle to reduction which has exercised the talent and ingenuity of surgeons, from the time of Hippocrates to the present day: and by its removal alone can we hope to accomplish the desideratum of an easy restoration of the displaced parts to their normal relations.

Pott has the glory of having been the first to establish the important principle of relaxing the muscles to effect reduction; —a principle the value of which many years of experience have abundantly proved to me.

The first indication to be attended to in the reduction of fractures, as of dislocations, is to relax the muscles, and this is fulfilled by position. It is, at the same time, requisite to prevent the recurrence of spasm, which pain, and even still more the fear of pain, unceasingly tends to produce: for this purpose the surgeon must tax his ingenuity in distracting the attention of the patient by earnest questions, interpellations, upbraidings, and the like.

These general principles are entirely applicable to the reduction of fractures of the fibula, accompanied by dislocation of the foot: and there is no reduction more easily accomplished, when the muscles are suitably relaxed. For this purpose it is only necessary to bend the leg upon the thigh, and to divert the attention of the patient; all resistance then ceases as if by magic, and the displaced parts resume their natural position almost without effort or interference on the part of the surgeon: the same measures are equally efficacious in other fractures of the leg.

There is, however, yet something to be done to render the apparent reduction real and complete: for the action of the peronei muscles on the foot is constantly tending to perpetuate the malposition of the lower fragment of the fibula, the former being thus everted, and the latter being consequently tilted inwards towards the tibia. It is this circumstance which so frequently leads to deformity, where appropriate measures are not adopted to obviate the tendency alluded to.

In addition, then, to relaxation of the muscles and extension in the direction of the axis of the leg, the surgeon must employ some means for drawing away the lower fragment of the fibula from the tibia, in order to render the reduction complete: and this is to be effected through the intermediate agency of the foot upon the outer malleolus. It must be borne in mind that though the malleoli, whilst perfect, serve to limit the lateral motions of the foot, they very readily accompany the foot (through their ligamentous attachments) when separated from the shafts of their respective bones: and thus, by abduction or adduction of the foot as the case may be, the corresponding ligaments draw down the inner or outer malleolus; and it is in this way that the upper end of the lower fragment of the fibula is tilted outwards and brought into its proper position. Indeed, this adduction of the foot is productive of another effect which aids in realizing the desired object: for the lower extremity of the tibia is thus forced outwards against the astragalus, which in its turn presses against the outer malleolus; and thus, by this combined effect, the fractured ends are kept accurately in position.

Of the means for retaining the parts in their proper relations.—These means flow from, and are the application of, the principles just enumerated: and as there is no innate tendency on the part of the bones themselves to displacement, it naturally follows that, by protecting the injured parts from external violence, and by counteracting the disposition to muscular spasm, the surgeon will be enabled to carry out these principles.

It is evident, then, that position is equally important in the after-treatment as in the reduction of fractures: and in no cases is relaxation of the muscles more imperatively required than in fracture of the fibula. Numberless instances have I seen in which momentary extension of the leg has reproduced the displacement which had just been remedied. (See Case XVI.) I have, therefore, adopted generally Pott's method, in this as in other fractures; having likewise proved its advantage over the straight position in fractures of the neck of the femur. I now proceed to point out the appropriate method of treatment in the different forms of injury about the ankle-joint.

The means to be employed in cases of dislocation inwards of the foot.—Where the fibula is fractured, and there is accompanying dislocation of the astragalus inwards, an apparatus is required which will retain the foot in an adducted position, and keep the tibia pressed outwards; at the same time that the lower fragment of the fibula is raised and separated from the tibia, and thus placed in a line with the shaft of the bone. This apparatus should, moreover, be simple and easily attainable; such, in short, as I am about to describe, and have employed since 1806.

A pad, a splint, and two rollers constitute the whole. The pad should be two feet and a half long, about five inches broad, and from three to four inches thick, similar to that which is employed in fracture of the thigh. The splint must be twenty inches long, two inches and a half broad, and the third of an inch thick; and the wood should be stiff and unyielding. Lastly, the rollers should be each five or six yards in length.

The pad, folded corner-ways on itself, should be applied along the inner side of the leg, with its base downwards, extending to but not beyond the inner malleolus, its narrower part resting against the inner part of the head of the tibia. Upon this the splint is to be adjusted, so as to extend five or six inches below the pad, and four or five beyond the inner border of the foot; its upper extremity being supported by the folded part of the pad above, on which it is to be fixed by one of the rollers. The lower end of the splint is thus prepared, by separation from the foot, to act advantageously in adducting it, when they are drawn together by the second roller, which is to be applied in a figure-of-eight fashion over both splint and foot, embracing alternately the heel and instep. The splint is thus converted into a lever of the first order, the power and resistance being severally at either extremity, whilst the fulcrum is at the base of the pad, a little above the inner malleolus. In this way the foot is drawn inwards, and the tibia pressed outwards; whilst the astragalus is at the same time brought into position through the medium of its ligamentous connexion to the fibula, the lower fragment of the latter being tilted outwards by the pressure exerted on it by the tibia.

It must be borne in mind that, for complete reduction, the foot must be carried inwards into a complete state of adduction; and this is neither difficult of execution nor painful. It must be persevered in through the whole treatment, and in the course of a few hours after the apparatus is ultimately removed, the foot will resume its normal position beneath the tibia. The following case clearly illustrates the satisfactory application of these principles, as well as the sufficiency of the apparatus I have just described.

Case XXII. *Fracture of the fibula, with deviation of the foot outwards.*—Jeanne Sophie Goly, aged 35, very corpulent and of sanguineous temperament, was quarrelling with a companion, when she fell on her right side, having her right foot jammed between two compartments of the pavement; she immediately felt an acute pain at the lower part of the leg, and made some attempts to disengage her foot and rise; but falling again, she was soon brought to the Hôtel-Dieu. This occurred in 1807.

Though the tension and swelling were great, a fracture of the lower part of the fibula, about two inches from its extremity, was detected, accompanied by deviation of the foot outwards: the inner malleolus and astragalus projected beneath the skin on the inner side of the joint. The parts were reduced, and lateral pads and splints applied with an eighteen-tailed bandage.

As fever and inflammation ensued, the patient was twice bled and put on low diet.

In spite of this treatment, after four days had elapsed, the injured parts were as much displaced as at the time of her admission, and the inflammation was very intense. Under these circumstances I had recourse to the apparatus I have just described, and which I had previously planned for cases of this sort. But first of all it was necessary to reduce the parts, which I effected by placing myself on the side of the fractured limb, and, whilst one assistant was directed to make extension with his hands on the instep and heel, and another to make counter-extension from the upper part of the leg, I distracted the attention of the patient; and the muscles being relaxed by this manœuvre and flexion of the knee, I succeeded in restoring the joint to its normal form. I then applied the apparatus in the way just now represented, in doing which I required the aid of my assistants. When completed, the foot was so much adducted that its plantar surface faced inwards, and its inner border upwards: and by this arrangement the prominence of the inner malleolus was entirely obliterated, and the lower fragment of the fibula raised to its proper position. Moreover, the interval between the inner side of the joint and the splint allowed of the application of an evaporating lotion, which could be renewed at pleasure without disturbing the adjustment of the splint. The limb was then placed, semi-flexed and on its outer side, on a pillow.

During the five weeks of treatment, the apparatus was re-applied three or four times, and when ultimately removed, the amount of adduction of the foot required that the splint should be adjusted on the outer side of the limb for a short time. This patient soon afterwards left the hospital, without any deformity and quite cured.

Of the means for maintaining reduced the dislocation backwards.—The preceding apparatus is adapted for all cases of fracture of the fibula, accompanied by dislocation of the foot inwards or outwards, or even outwards and upwards. In the latter forms of dislocation it is requisite to place the splint on the fibular, instead of the tibial, side of the leg, in order that the foot may be thus drawn outwards. But where the dislocation is backwards there is much more difficulty to cope with, both in reducing the parts and keeping them in position; and a different arrangement is necessary to effect the latter object.

I have already remarked that this dislocation can only occur when the fibula is fractured, and the inner malleolus has given way: the unfettered foot is then drawn back by the power of the gastrocnemii, and the astragalus is thrown behind the tibia, whilst the latter is thrust forwards beneath the tendons and skin on the instep.

The difficulty of reducing this form of dislocation is owing to the powerful resistance offered by the muscles, though this is to a certain extent negatived by relaxing them and distracting the patient's attention; but the surface of the astragalus is so slippery, and the strength of the muscles so great, that there is a continual tendency in the foot to slip again out of place, even when reduced. The indications then are, to press on and push forwards the foot, at the same time that the tibia is forced back into its natural position: and for this purpose I employ the same apparatus as in the other forms of dislocation, with the addition of a small square pad.

First of all the long pad is placed along the back of the leg, folded as in the other cases, so as to extend from the heel to the ham, its base being downwards: over this the splint is applied, being first fixed above by one of the rollers, whilst the other is carried round the lower part of the leg and splint. The heel is thus thrust forwards and the tibia drawn backwards; and so great is the power thus acquired, that it is necessary to be cautious in not exerting too much pressure. The tibia should be protected from the compression of the roller by the square pad. The following is an illustration in point.

Case XXIII. *Fracture of the tibia and fibula; with dislocation of the foot backwards.*—Marie Clément, aged 67, a labouring woman, became suddenly giddy whilst lighting her fire, and fell backwards, with her left foot fixed between a table and the fire-place. Little or nothing was done for her for four days, at the expiration of which time she was brought to the Hôtel-Dieu.

On admission, the following appearances presented themselves. The fore-part of the foot was shortened and the back part elongated, so as to make them nearly equal in length. The shafts of the tibia and fibula, separated from their malleoli, were carried forwards to the front of the tarsus, where they forced up the tendons and skin ; whilst the malleoli themselves, being held in contact with the foot by their ligaments, accompanied it in its displacement backwards. The fibula was broken two inches from its extremity, but the inner malleolus was fractured at its connexion to the tibia. There was no lateral deviation of the foot, and very trifling mobility from side to side : the ankle could not be flexed, but the foot could be carried further backwards, by which the signs of dislocation were rendered still more apparent.

I effected the reduction in the same way as in the last case, but the involuntary spasm of the muscles almost immediately reproduced the displacement, when the parts were left to themselves. I then had recourse to the apparatus which I have just described, and subsequently fixed the limb, in a semiflexed position, to the side of the bed : the patient experienced immediate relief.

On the ninth day I removed the apparatus, and found the foot in proper position, and that the swelling had subsided ; but the skin covering the heel and lower part of the spine of the tibia was a little reddened and fretted by the pressure. I therefore bandaged the limb, in hope that the dislocation would not again occur. I was, however, deceived, for on the fourteenth day a disposition to the same displacement as existed before had again manifested itself, though the skin had recovered a healthy condition. I was now satisfied of the importance of persisting in the same treatment as that which had been so successful ; and I accordingly again adjusted my apparatus, taking the precautions of protecting the spine of the tibia by a pad, and of not drawing the lower roller tighter than was essential to combat the tendency to dislocation.

From this time no further difficulty presented itself. After the lapse of thirty days the apparatus was finally removed, the fractures being united, and the foot entirely free from deformity. The patient was permitted to move the joint ; and shortly after quitted the hospital quite well.

When fracture of the fibula is complicated with dislocation of the foot both inwards and backwards, it is generally sufficient to employ that form of apparatus which is adapted to the prevailing displacement: and, if necessary, both forms may be combined in the treatment of dislocation backwards and outwards, by which the double indication to draw the foot forwards and inwards will be fulfilled.

Such then is the fundamental principle upon which the treatment of all these cases should be conducted; for, when the dislocation is reduced, and the tendency to its recurrence is subdued, the accident then assumes the restricted character of a simple fracture, and as such is readily cured.

Parallel between the old and new methods.—It may be objected that the old method was equally efficacious in the treatment of these injuries: but my own observation and experience have so repeatedly proved the fallacy of this assertion, that I am tempted to illustrate it by the following instances.

CASE XXIV. *Double fracture of the fibula; with dislocation of the foot inwards and backwards.*—Blondeau, a butcher, aged 62, fell on his right side, whilst his left foot was fixed in a rut. He experienced severe pain and heard a loud snap near the ankle-joint at the moment: this was succeeded by swelling and great constitutional disturbance; but he was not brought to the Hôtel-Dieu until nine days after the accident.

The nature of the injury was immediately detected, one fracture being at the base of the outer malleolus, and the other two inches higher up: the dislocation was very marked. For nearly a fortnight after his admission, the common plan of treatment was adopted, but without in the slightest degree controlling the displacement of the foot. I then directed that my apparatus should be applied; and from this time the tendency to dislocation was subdued, and with it the suffering and swelling: the patient left the hospital well, after wearing the splint for six weeks.

CASE XXV. *Fracture of the fibula with dislocation inwards.*—Jean Guillaume Malemberg, interpreter, fell from a ladder, and thus fractured his fibula near its lower extremity; this injury was accompanied by dislocation inwards and prominence of the inner malleolus, at which point the skin was very tense. In this case, after reducing the displaced parts, I applied my apparatus, and the patient went on well for a week, after which the ordinary splints were applied, the parts at the time being in a perfectly normal relation to each other. The limb began to suffer almost immediately, and in forty-eight hours the tibia again projected inwards, a threatening inflammation of the skin commencing at that point. Still the same treatment was persevered in: the skin sloughed; abscess after abscess formed around the joint, and the patient remained in the hospital for eight months, when he went out, with the foot much abducted and anchylosed to the bones of the leg; the inner malleolus was very prominent, and he had almost entirely lost the use of the leg in walking.

These are striking examples of the advantage of the new over the old plan of treatment. There can, then, be little doubt of the correctness of the principles I have established: whether the method of carrying them into effect be the best adapted for that purpose, experience alone can prove.

Effects and general results of the new plan of treatment.—The history of two hundred and seven cases treated by myself, and by others who have adopted my method, constitutes the basis of the summary remarks I shall presently make. I have already observed that the most direct and important effect of the apparatus I employ is, to restore the foot to, and retain it in, its natural relation to the leg. But there is a second and scarcely less important result, which is the accurate adjustment of the fractured extremities of the fibula in apposition with each other: and this I have tested by anatomical examination in two cases, as well as by repeated observation after a cure has been completed.

CASE XXVI. *Fracture of the fibula, with dislocation of the foot inwards. Death.*—Riga, a poor fellow, worn out by disease and misery, was thrown down by a carriage in 1809, and had his fibula fractured: by the effort of attempting to get up and walk afterwards, a consecutive dislocation of the foot inwards was produced. He was brought to the Hôtel-Dieu, where the parts were reduced to their normal form and my apparatus was applied. It was worn for six weeks, and with entire success, in spite of great intractability on the part of the patient, who was then seized with fever, convulsions, and hemiplegia, under which he speedily sank.

The cause of death was found to be a tumour in the internal temporal fossa, between the dura mater and skull.

A careful dissection of the injured limb was made. On exposing the fibula, a slight fulness was observed around its lower extremity, thickest in the centre, and gradually blended with the periosteum above and below. It consisted of the newly-formed bone, which was soft and spongy, being easily cut through with a knife, and in which fibres parallel to the axis of the bone were visible; these were continuous with those of the periosteum above and below, mingling with them, by an insensible conversion of their osseous nature into one of a cartilaginous and fibrous character.

The *provisional* callus being raised, the line of oblique fracture of the fibula was seen, the two fragments being accurately in apposition, without the slightest deviation in any direction. Nevertheless, although this was the case, and two months had elapsed since the receipt of the injury, the fractured ends were not reunited by continuity of substance; they were only in contact; for the *permanent* callus was not yet formed, and had not as yet supplanted the *provisional* deposit.

The following case speaks yet more strongly in favour of the special apparatus, as the injury was of a more complicated and serious character.

CASE XXVII. *Fracture of the fibula, with dislocation of the foot outwards; succeeded by pleurisy and death.*—A powerful man was knocked down by a four-wheeled carriage, one of the front wheels of which passed over the outer and lower part of his right leg in an oblique direction, and one of the hind wheels passed over his chest. The consequence of this accident was fracture of the fibula low down, and of five or six ribs near their vertebral extremity. The foot was displaced outwards, so that the astragalus formed an elevated prominence beneath the inner malleolus, and there was much blood extravasated: the pain was severe, and swelling was rapidly increasing. My apparatus was applied to the leg; but time was not allowed for the cure to be completed, as the patient sank under pleuro-pneumony eighteen days after the accident.

The extravasated blood was almost entirely absorbed. The fibula was found broken longitudinally, the fracture extending from the joint upwards for more than three inches, where it terminated beneath the peronei muscles: but the bone retained its natural direction throughout. A fibro-cartilaginous deposit, presenting some ossific nuclei here and there, formed the provisional callus around the fractured ends: and on raising this, the broken extremities of the bone were found to be in perfect apposition. No change had taken place along the line of fracture, which was as clean as if the accident had only just occurred. The provisional callus of the ribs was in a much more advanced state than that of the fibula.

Another advantage presented by the new mode of treatment is, the cessation of the severe pain occasioned by the displacement of the fractured ends of the bone. The testimony of patients in this respect has been uniform, and in some instances very remarkable.

A further effect, and one closely allied with the last, is the rapid diminution of the swelling and tension around the joint, as most of the preceding cases testify.

I recollect, however, one exception to the above remarks; and that was in the case of a man who was admitted into the Hôtel-Dieu in 1814, with comminuted fracture of the fibula. The house-surgeon would persevere in the use of my apparatus, in consequence of which the patient sank under the irritative fever, set up by excessive suffering. On examination, it was found that the nature of the fracture was such, that the spicula of bone were forced into the soft parts by the application of the splint, whence the symptoms which led to a fatal result. It is scarcely necessary to add that in addition to the primary effects already enumerated, all the secondary and consequential results of inflammation, suppuration, gangrene, &c., are likewise obviated by this plan of treatment.

I will conclude this subject by placing before the reader some tables of cases treated according to this method.

These fractures (of the lower part of the fibula) held a varying numerical relation to other fractures of the leg, according to the season and other circumstances: they were as 1 to $1\frac{1}{3}$, 1 to 2, 1 to 3, 1 to $3\frac{1}{2}$, 1 to 4; and sometimes the proportion was even less.

Omitting small fractions, of the two hundred and seven cases of which I possess an authentic record,—

$\frac{7}{10}$ were fractures of the right leg;

$\frac{3}{10}$ of the left.

As to the causes,—

$\frac{6}{10}$ resulted from forced adduction of the foot;

$\frac{3}{10}$ from forced abduction;

$\frac{1}{10}$ from blows or the passage of heavy weights over the lower part of the leg.

As regards their position,—

$\frac{5}{10}$ existed at two inches from the extremity of the malleolus;

$\frac{3}{10}$ below this point;

$\frac{2}{10}$ above it.

Those which had their seat within two inches of the point of the malleolus were frequently complicated with displacement (of the foot); the others rarely.

As regards their condition,—

$\frac{9}{12}$ consisted of a simple solution of continuity, transverse or oblique, and at only one point of the bone: these were generally the product of forced abduction or adduction;

$\frac{2}{12}$ consisted of a solution of continuity at two several points; and the greater part of them were the consequence of force directly applied;

$\frac{1}{12}$ were comminuted fractures, resulting generally from some crushing accident.

As to displacements,—

$\frac{2}{20}$ were without any, and also without laceration of the internal lateral ligament, or fracture of the inner malleolus: they were all cured without difficulty or deformity in one month;

$\frac{18}{20}$ were accompanied by displacement in various directions.

Of these $\frac{18}{20}$, somewhat less than $\frac{14}{20}$ were accompanied by dislocation inwards, that is, of the astragalus towards the inner malleolus, and of the foot outwards in a state of abduction: and amongst these,

$\frac{4}{20}$ occurred without apparent laceration of the internal lateral ligament or fracture of the outer malleolus: all of these turned out as well as if no displacement had existed;

$\frac{8}{20}$ were accompanied by evident laceration of the internal lateral ligament, or the compact extremity of the inner malleolus was torn away;

$\frac{2}{20}$ presented fracture of the base of this malleolus or of the lower extremity of the shaft of the tibia: all of these which exhibited no further complication were cured almost as speedily and perfectly as the preceding.

Somewhat less than the $\frac{4}{20}$ remaining were accompanied by dislocation of the foot backwards and inwards; and in all of them there was laceration of the internal lateral ligament, and the corresponding malleolus was fractured.

The dislocation backwards has, in some instances, resisted both position and the mechanical means employed for restoring the normal relation of parts; but dislocation inwards was always under command.

Lastly, in two hundred and seven of these fractures, there were only three which were complicated by simple dislocation of the astragalus outwards and of the foot inwards. The application of the apparatus on the outer side of the leg was as effectual in accomplishing a cure, as the corresponding treatment when employed in dislocation inwards.

Almost all the cases were accompanied by extravasation of blood.

$\frac{15}{20}$ of these were simple ecchymoses;

$\frac{5}{20}$ extensive effusion into the areolar tissue or beneath the fascia of the leg.

Of these extravasations,—

$\frac{3}{5}$ terminated by resolution and without opening;

$\frac{1}{5}$ by spontaneous discharge after inflammation; and

$\frac{1}{5}$ in the same way, after the separation of sloughs.

The ecchymoses were easily cured; as were also the larger effusions when the air was excluded. Very little mischief ensued when the escape of the blood followed the separation of sloughs; but the consequences were more serious when it succeeded inflammatory action.

The fractures accompanied by laceration of the skin were about 1 in 17: and of these cases,—

$\frac{2}{5}$ presented this complication on the inner side of the joint, the laceration corresponding to, and resulting from, the protrusion of the fractured extremity of the shaft of the tibia; in

$\frac{1}{5}$ only, it corresponded to the fractured extremity of the shaft of the fibula; and in

$\frac{2}{5}$ it existed at various points, being produced by the action of foreign bodies. The lower fragments of the fractured bones in no instance caused these wounds.

Fifteen patients, or $\frac{1}{14}$ of the whole, suffered from inflammation, which always affected simultaneously the skin and subcutaneous areolar tissue. In those cases in which it was limited to these textures, it usually terminated by resolution; and sometimes by suppuration, the abscesses being opened as they formed, by which means the skin was saved. In some instances the seat of fracture and the joint were implicated; in which cases the symptoms frequently assumed an adynamic character, and the result was fatal.

Seven individuals, or $\frac{1}{30}$, suffered from death of bone or tendon. In three cases the tibia or inner malleolus was the seat of necrosis; in one only the fibula, at its lower extremity; the causes being suppuration or primitive separation of spicula: but in all the loss was repaired.

There were three cases in which tendons sloughed; in two the tibialis anticus and extensor pollicis, the mischief resulting from pressure of the broken end of the shaft of the tibia, itself caused by dislocation of the foot backwards: in one case the peronei tendons sloughed in consequence of injury received from the broken shaft of the fibula. These accidental circumstances retarded the cure, but did not sensibly affect the movements of the foot.

Eight individuals, or nearly $\frac{1}{26}$ were affected with nervous delirium, which was not inflammatory, and lasted from two to five days. It recurred once in three cases, and twice in a fourth. In all it yielded to opiate injections.

Several of the patients suffered from spasmodic affections, which ceded to bloodletting and antispasmodics.

The duration of the treatment in most of the cases was from twenty-five to thirty-five days: in the more serious cases it extended to forty or even sixty days. Where necrosis, exfoliation, and sloughing followed, it was protracted to one hundred days and upwards.

In the report of eight cases by M. J. Hatin, consolidation of the fracture took place in from twenty-one to forty days: the period of convalesence being double that of the treatment. The adducted condition of the foot on removal of the apparatus was soon remedied, as already noticed.

In two cases only was there any deformity, and in one only loss of mobility: in the former the heel projected and the base of the tibia was prominent, in the latter there was anchylosis of the ankle-joint.

Thus, of two hundred and seven cases treated on my plan, two hundred and two were cured, five only dying: and of these, two sank from other causes unconnected with the injury of the leg. This must be admitted to be a good average even in cases of the most common fractures, and especially so where the prognosis in similar accidents used to be so unfavorable, and the issue frequently so unsatisfactory. In no single instance did I find amputation, either primary or consecutive, necessary.

CHAPTER XIV.

ON DISLOCATION OF THE ASTRAGALUS FROM THE OS CALCIS. PRACTICAL CONSIDERATIONS ON THE CAUSES OF THIS DISLOCATION, AND ITS TREATMENT. EXTIRPATION OF THE ASTRAGALUS.

The astragalus and os calcis being connected by several very strong ligaments, which bind the bones together so as to permit but very limited gliding motion between them, it was formerly considered impossible that dislocation of this joint could occur. Their size, form, and spongy texture led also to the impression that a force, operating indirectly, might crush these bones, but could scarcely cause a mere fracture. The ancients seem not to have known the dislocation in question; and many surgeons reject the idea of its practicability, for the reasons already stated: Astley Cooper regards it as a very rare accident, and speaks of it as involving serious consequences; for, says he, if it is not reduced, which is usually the case, the patient is condemned for the rest of his life to considerable lameness. As some ten or twelve instances of this lesion have come under my observation, I will select a few of them to illustrate its nature and treatment.

Case I. *Dislocation of the astragalus; partial reduction.*—Lebrun, aged 47, a German by birth, of vigorous constitution, fell down as he was going into his house, but was unable to give any account of the nature of his fall. He immediately experienced acute pain in the left foot, and perceived that it was deformed: after crawling to his bed, and suffering much the whole night, he was brought to the Hôtel-Dieu on the following morning: the symptoms which then presented themselves were as follows. The foot was twisted considerably inwards; and there was a sort of wedge-shaped depression immediately below the inner malleolus, which point could no longer be felt: the outer malleolus, on the contrary, was prominent; and a second projection irregular and angular, was perceptible below and in front of the former: the skin was very much distended over this point, as well as contused and slightly excoriated; and there was also another very distinct prominence, of a rounded form, anterior to the outer ankle. In addition to the above symptoms, there was total incapacity, on the part of the patient, to move the foot; and any attempt at passive motion was attended with acute pain, although there was freedom from suffering when the limb was at perfect rest: the swelling was moderate, and the foot appeared a little shortened and carried backwards. Careful examination of the leg proved that both tibia and fibula were sound.

From the above signs I concluded that the astragalus was dislocated outwards and forwards, with separation, probably, of the two bones which constitute the mortice for receiving it: but whether the astragalus itself was turned upside down, or retained its natural relations in this respect, I could not decide. Under any circumstances this dislocation is a serious one, on account of the difficulty and sometimes the impossibility of reducing it, as well as from the injury done to the ligaments and surrounding soft parts: but, on the other hand, I have in some instances succeeded, with surprising facility, in restoring the bone to its normal site; and to attempt this appeared to be the indication in the present case. In the event of failure, one of two results might be anticipated; either the foot would be inverted and weak, and the act of progression difficult and painful; or if symptoms of inflammation and strangulation supervened, and threatened further mischief, it would be necessary to have recourse to extirpation of the displaced bone. This is an operation which I have performed three or four times with perfect success: all the patients recovered, with shortening of the extremity and slight lameness it is true; but purchasing, at this cheap rate, immunity from the frightful impending consequences of inflammation, which have induced some surgeons to recommend amputation as a preferable alternative to leaving the astragalus unreduced.

The following steps were taken in attempting the reduction in this case. The patient was placed horizontally on a bed, with his head towards an iron ring in the wall of the amphitheatre. The middle of a cloth, folded diagonally, was passed under the left thigh, which was flexed at right angles on the pelvis; and the ends of this cloth were placed in the hands of two assistants, for the purpose of counter-extension. A second cloth, similarly folded, was passed beneath the right shoulder, and likewise intrusted to assistants, who were directed thus to steady the trunk and aid in making counter-extension. A third cloth was wound over the instep and crossed in the sole of the foot, where it was fixed by means of a roller, several folds of which were carried behind the heel: the ends of this cloth were put into the hands of three strong assistants, with directions to make extension. I then placed myself on the left of the patient, and ordered that extension should first be made in a direction from without inwards, and then from within outwards, whilst I endeavoured to press the bone into its place: this manœuvre was tried several times in succession, but without making any impression on the distorted parts. I therefore relinquished the attempt for the time being, and directed that the patient should lose some blood, and be kept in a tepid bath for some hours: the joint was afterwards to be enveloped in a poultice, and an anodyne draught to be taken in the evening.

On the following day the attempt to reduce the dislocation was renewed, but ineffectually as concerned complete reduction. Nevertheless, there was a manifest improvement in the form of the limb: the depression which existed above the outer malleolus was considerably diminished; and the prominences below and in front of this apophysis were less conspicuous: yet the reduction was far from complete. The patient was conveyed back to bed, and the foot and lower part of the leg were enveloped in a poultice. As no untoward symptom displayed itself in the course of the two or three following days, a further effort was made to give the foot its natural direction, by applying on the outer side of the leg the apparatus I am in the habit of using in fracture of the fibula. A pad was placed on the fibula, and over it a splint, which was fixed to the upper and lower parts of the leg by two rollers, the lower extending to the foot. This was succeeded in a couple of days by a sharp attack of inflammation, which was subdued by antiphlogistic measures: and after this the patient would not allow anything more to be done to the limb. He remained for some time longer in the hospital, and when he left he was quite free from pain, the foot was only slightly inverted, and the points of the toes were directed a little more downwards than natural.

In some instances, as I have already remarked, these dislocations are reduced with great facility. A case occurred to me some years back in which an individual, a grocer by trade, dislocated his astragalus, and I reduced it without the employment of any violent measures. The patient got quite well; and, to this day, uses his limb as well as if it had never been injured: moreover, there was not the slightest deformity of the foot.

Case II. *Dislocation of the right astragalus outwards; reduction and cure.*—Nicolas Buisson, aged 24, a porter, was admitted into the Hôtel-Dieu in 1820, with dislocation of the right astragalus outwards and forwards. This patient, who was of powerful frame, was carrying a sack of wheat on his shoulders, and fell with his burden, in consequence of meeting with a step whilst he thought he was walking on plain ground. In this fall, which was on the right side, the foot was violently twisted inwards; and the resistance offered by the external lateral ligaments being overcome, the astragalus was dislocated outwards and forwards. At the same moment the patient experienced acute pain, and a sort of puffing up of the tibio-tarsal articulation; he was, however, able to rise, but could not stand, on account of his foot being turned completely inwards.

When he was admitted into the Hôtel-Dieu the following symptoms presented themselves. There was considerable swelling around the right ankle-joint and at the lower part of the leg; and the foot was so much adducted that its plantar surface was directed inwards; the lower extremity of the tibia was buried from view, as if driven into the inner side of the joint, whereas the fibula was unusually prominent on the outer side, but neither of them was broken: the skin which covered these parts was tense, and seemed ready to burst. Before and to the inner side of the fibula, and a little in front of the tibia, an osseous tumour was perceptible; this was the articular pulley of the astragalus: lastly, the joint was surrounded by large patches of ecchymosis.

By taking the precaution of relaxing the muscles, I succeeded very easily in reducing this dislocation: some wetted compresses were then placed around the articulation, and confined by a roller: I also directed that the patient should lose blood and be kept on a low diet. The only untoward symptom which afterwards occurred was the formation of a small slough over the outer malleolus: this soon separated; but the patient was kept at rest for six weeks, and finally left the hospital at the end of the second month, entirely cured.

The facility with which the astragalus was reduced in the above instance is by no means invariable, as the first case proves: and again, the reduction is sometimes altogether impracticable, the necessary consequence of the failure being permanent lameness, unless the displaced bone is removed. An illustration of this came under my observation in 1826, in which a gentleman had an irreducible dislocation of the astragalus, and, declining the operation of having it removed, ever after had the foot turned inwards, and walked with inconvenience and pain. In the three or four instances in which I have extirpated the astragalus, I have found, with one exception, its position reversed, which satisfactorily accounts for the abortive result of the attempts at reduction: in the exception alluded to, the displacement was simple, and yet the effort to reduce it was equally unavailing.

M. Clisse, whom Sir Astley Cooper cites, succeeded in reducing dislocation of the astragalus in several instances, by the following means. The thigh being placed at a right angle with the body, he grasped the metatarsus and tuberosity of the os calcis with both hands; and whilst the foot was extended gently and directly from the leg, the operator pressed on the outer side of the joint with his knee, and thus effected the reduction by means of this counter-pressure. A splint was afterwards attached to the fibular side of the leg, and the limb was then placed on its outer side.

Amongst the causes operating to oppose reduction, the configuration of the astragalus and calcaneum must be taken into the account. Thus, the hooked process of the former may catch in the groove between the articulations of the latter, when the astragalus is dislocated forwards without being turned upside down; and then it is impracticable to move it from this position. But again, in other instances the facing of the bone is completely reversed, so that its upper surface is directed downwards, and the converse: this is a condition which baffles all attempts to remedy it. In other cases the reduction is accomplished with comparative facility, a circumstance which I am disposed to attribute to the amount of injury sustained by the connecting ligaments. When the ligaments are not actually ruptured, but merely stretched and distended, they retain the bones in the new relations they have assumed, and even more firmly so than in their normal position; hence the complete immobility of the dislocated astragalus in some instances. But when, on the contrary, there is much laceration of the ligaments, the bones are readily moved on each other, and the reduction is proportionately easy.[1] Again, there is not much difficulty to encounter when the hooked process on the back of the astragalus is not lodged in the groove of the os calcis; and when its position is a little posterior to this point, very slight pressure backwards is sufficient to restore the displaced bone to its normal position. Such are some of the more common causes which operate prejudicially or otherwise, in influencing the reducibility of this dislocation. I will now relate a case illustrative of that condition which calls for removal of the astragalus.

CASE III. *Complete dislocation of the astragalus, with laceration of the soft parts. Fracture of the humerus, of the pubes, and of the fibula. Extraction of the astragalus; and cure, with shortening of the limb by one inch.*—Adélaïde Aldebert, aged 23, of nervous temperament, was admitted into the Hôtel-Dieu in 1818. About six months previously she had thrown herself from a fourth story window, and was immediately conveyed to the Charité Hospital, where her recovery was despaired of; for she was insensible, and her body was covered with bruises, besides the injuries enumerated in the heading of the case. The fractures were reduced, and the patient rallied, and ultimately quitted the hospital, though not well; as she still suffered from pain in the kidneys and bladder, as well as from incontinence or retention of urine. The dislocated astragalus had been neither reduced nor removed; and her total inability to use the limb, was the cause of her application for admission into the Hôtel-Dieu, that she might have it amputated. At this period, the limb presented the following appearance. The leg, in its lower fifth, was arched and hollowed internally, and the foot was so twisted that the sole was turned towards the inner malleolus of the left side, and it consequently rested on its outer border. Under the skin on the dorsal surface of the foot, or, rather, under an irregular cicatrix, was the astragalus, which, from its position and prominence, in a measure imparted to the limb the appearance which is presented by the deformity of a clubbed-foot. This bone was movable anteriorly, but seemed to be anchylosed behind. When the patient stood she rested on the outer edge of the foot; and in attempting to bear upon the limb, severe pain was occasioned at the ankle-joint, and spasm in the calf of the leg. Now, I recollected having removed the astragalus in a similar case, where dislocation of this bone was complicated with fracture of the fibula, and the patient recovered the use of the limb: I therefore proposed a similar operation in this instance; which, being consented to, I performed in the following way.

---

[1] [This explanation was, we believe, first propounded by Boyer.—TR.]

I first made a crucial incision over the cicatrix and head of the astragalus, and then disengaged the latter from its fibrous and cellular connexions to the surrounding bones, quite to its back part. A cord was next fastened around its neck, to assist me in drawing it out, but it was not yet prepared to leave its position, in consequence of its firm attachments behind. I therefore had to make some further dissection, and having included the neck in a second noose, I ultimately succeeded in dragging the bone from its place. The operation was neither difficult nor tedious, and very little blood was lost: the wound was dressed, and the foot bandaged.

In the course of an hour after the operation, there was a good deal of spasm in the limb, attended by wandering pains in the abdomen and a contracted pulse; for which the patient was bled and had an anodyne draught exhibited. She suffered, however, a great deal from nervous excitement and other constitutional disturbance: the wound also became inflamed, but the suppuration was healthy. A splint, such as I use in fracture of the fibula, was applied on the outer side of the limb, to counteract the tendency to adduction of the foot. On the tenth day the patient's general health was much improved; and on the thirtieth the wound was nearly healed, and the foot retained its proper position without artificial assistance. The constitutional disturbance again manifested itself on the thirty-second day, but soon yielded to the application of leeches to the neck, the head being principally affected this time. The patient began to walk on the fortieth day, but the cicatrix was not yet firm enough to bear the exercise, and consequently reopened; I therefore ordered a laced-boot to be made, strengthened on each side by a plate of steel, to prevent adduction or abduction of the foot, and also to support the cicatrix. In the course of a short time she dispensed with this mechanical aid, and was able to follow her usual occupations when she left the hospital, by wearing a high-heeled shoe.

The above case satisfactorily proves the practicability of removing the astragalus, and of obtaining a cure without any very sensible deformity. This bone has been removed in a great many instances, with perfect success, where its dislocation has been attended with lesion of the soft parts: amongst others, M. Desault has extirpated it three times, and all the patients did well. But those cases in which the operation was performed, where no external wound existed, are more rare; this is my reason for citing the case which I have just narrated. It would be superfluous and useless to enter into details, or to give any specific directions in reference to the mode of operation: a simple incision over the prominent bone, and the employment of the fingers or a pair of pincers, are the only steps which are usually requisite. In short, the isolated astragalus must be treated as a foreign body, and the removal of it is far preferable to repeated attempts at reduction. The hollow which is left by its removal is gradually filled up, the tibia accommodates itself to its new position on the upper part of the os calcis, and the shortened limb is well capable of sustaining the superincumbent weight. I do not mean to assert that there is no risk attending this operation, but merely to state that I have always found it successful; and every surgeon must act for himself according to the judgment which he forms of the merits of the case, and after he has balanced the inconveniences and risk of the two alternatives presented to him.

CASE IV. *Dislocation of the astragalus forwards and outwards. Reduction and cure.*— J. H., aged 47, of powerful frame, was admitted, in a state of drunkenness, into the Hôtel-Dieu in 1838. He had been indulging himself in copious libations on the previous evening at a wine-merchant's where he lodged, and was going to his room, when he found he had forgotten his key. He accordingly turned back, but found the descent rather more troublesome than the ascent; and getting his left foot entangled in the balustrade, the whole weight of his body was thrown with great violence towards the opposite side, in consequence of which the external lateral ligaments of the ankle-joint were ruptured, and the astragalus was dislocated outwards. On admission, the deformity and immobility of the foot were sufficient to indicate the nature of the mischief; for its plantar surface faced inwards; whereas in fracture of the lower extremity of the fibula the reverse is the case. The astragalus formed a prominence beneath the outer malleolus, and appeared rather tightly wedged between the tibia and calcaneum; but not so as entirely to preclude motion.

The condition of the patient being favorable for reduction, he was at once conveyed to the theatre and placed on a bed. Extension and counter-extension were then made, as described in Case I; and as the parts gradually yielded, I pressed on the astragalus, and moved the foot in a direction so that it described the segment of a circle; and in this way the dislocated bone was directed upwards and inwards, and the two borders of the foot were brought to the same horizontal level.

From some cause or other, probably associated with the apparatus employed, there was some consecutive displacement in the evening. I tried to remedy this by employing a pad, but was obliged to relinquish the plan, in consequence of the suffering it induced, and a disposition on the part of the skin to slough. I therefore employed the same apparatus as for fractured leg, with the addition of a long fibula splint, by which the proper direction of the foot was preserved. This method succeeded perfectly, and the patient had no further relapse nor untoward symptom of any sort.

There is one point, in connexion with this injury, which I have not yet discussed; it is that which relates to the appropriate practice in cases, where the dislocated astragalus lies beneath the distended skin, the latter presenting no wound (and the former being irreducible). Should we follow the example of Desault, and cut down upon the bone and divide its ligamentous connexions, for the purpose of reducing it; or should we extirpate it? I am disposed to recommend the latter practice, as the astragalus, when thus isolated, would be little better than a foreign body, and might give rise to mischief which would render amputation necessary. An instance in which Desault selected the alternative of denuding the astragalus, and separating it from its surrounding connexions preparatory to reducing it, was attended with a good deal of after trouble and protracted lameness, though the case ultimately did well. The patient was a postilion, and was thrown from his horse, which fell upon him. Dislocation of the astragalus was the consequence, and the signs of the lesion were similar to those already described. After ineffectual attempts to reduce the displaced bone, Desault cut down upon it, and accomplished his purpose by separating its ligamentous connexions, but taking care not to injure the tendons. The case went on pretty well for four months, when there appeared considerable swelling around the joint, which was followed by exfoliation of a portion of bone. In the fifth month a second spiculum was thrown off near the heel. The patient then left the hospital, but afterwards returned, further portions of bone having exfoliated. At the expiration of a twelvemonth he was in the hospital, but ultimately went out perfectly cured; the only evidence of the injury being a little stiffness in the movements of the foot.[1]

---

[1] [In the fourteenth vol. of the Medical Gazette, p. 596, Mr. B. Phillips narrates two interesting cases which occurred in his practice, of dislocation of the astragalus *backwards*. In each of these cases "there were elongation of the heel, immobility of the foot, a projection of the tendo achillis, a shortening of the anterior portion of the foot, an anterior projection of the inferior extremity of the tibia. As the tumefaction lessened, the form of the astragalus was pretty distinctly defined." As attempts at reduction had been already made, Mr. Phillips declined meddling with the foot in either instance. In each case an artificial articulation was formed, and very little inconvenience resulted from the position of the displaced bone.—Tr.]

CHAPTER XV.

ON DISLOCATION OF THE METATARSUS.

It has been generally affirmed by authors, that the arthrodial articulations are not susceptible of displacement; an opinion which doubtless originated in the contemplation of their anatomical arrangement. Indeed, the plane surfaces of these articulations are so closely adapted to each other, so much strengthened by surrounding ligaments, and so protected against external violence, that one can scarcely conceive how dislocation could be produced without the employment of prodigious force, and accompanied by great displacement. In addition to the above considerations, it must be also remembered that these joints allow of no appreciable motion beyond a limited gliding movement, in which the relation of the articulating surfaces is scarcely changed.

Boyer was struck with these facts, and positively denied the possibility of the metatarsal bones being dislocated: so likewise Desault, Petit, and all other authors who have written on the subject of diseases of bone, say nothing whatever respecting this injury. I therefore assume that the cases I am about to relate are unique, or at any rate the first which have been observed; they were witnessed by a large number of pupils, and the greater part of the Royal Academy of Medicine.

Case I. *Dislocation of all the metatarsal bones on the corresponding bones of the tarsus.*—Françoise Voichot, aged 30, of excellent constitution, was brought to the Hôtel-Dieu in 1822. She stated that, in descending from the bridge of St. Michel with a burden of two hundred weight, she fell in such a way that the whole weight of the body was received on the right foot; and that at the moment she made an effort to check herself in falling, she experienced extremely severe pain in this part, and heard a very distinct snap: she was unable to raise herself from the ground.

On examining the two feet, one was found to be healthy, small, and perfectly well formed; the other, on the contrary, presented a remarkable lesion; for the arch, which is prominent in well-made feet, had given place to a plain surface, much more marked than in individuals affected with the deformity known by the title of *flat-foot*. At first this appearance led me to believe that the metatarsal bones were fractured: but being unable to detect either crepitus or mobility, I abandoned this idea. Then, the first metatarsal bone seeming to be longer than the others, whereas it is really the shortest, was also a little puzzling at first: but I soon perceived that it had maintained its relation with the inner cuneiform bone, and carried that with it, which accounted for the apparent anomaly; and there was no doubt about the other metatarsal bones being dislocated on the corresponding bones of the tarsus.

The short interval which had elapsed since the accident, and the entire absence of swelling, permitted of a ready verification of this anomalous condition of parts: the following was the state of the foot. Its length, as compared with the opposite foot, was diminished by nearly half an inch; and this was evidently dependent on the riding of the dislocated bones. Extending across its dorsal surface there was a transverse elevation quite half an inch in height, formed entirely by the posterior extremity of the metatarsal bones, and the inner cuneiform bone; but this was much more prominent internally than externally, so as almost to lead to the deceptive impression that the dislocation was not complete in the latter situation. Immediately behind this line of elevation was a corresponding depression, deep enough to allow of a finger being lodged in it, when laid across the foot. The concavity of the foot was quite obliterated by the sinking of the tarsal bones. Lastly, the extensor tendons stood out in strong relief, and raised the toes; which, together with the other parts concerned, were immovable: the integuments were uninjured.

There was no difficulty in determining under these circumstances, what was the proper course to pursue; and, considering the amount of laceration the ligaments must have sustained, I did not anticipate much resistance in effecting the reduction:

but as I was anxious to make the case as public as possible, I deferred the attempt until the following day. At the time appointed, the patient was conveniently placed on a bed, and the leg being flexed and bound with a folded cloth, was firmly fixed by assistants: extension was then made with a bandage suitably fastened to the foot; and I experienced very little difficulty, by pressing firmly on the dislocated bones, in accomplishing the reduction, which was accompanied by a loud snap, similar to that which the patient had heard when the dislocation took place. The deformity immediately disappeared, and the patient was in great measure relieved of the acute pain she had suffered since the accident; indeed, with the exception of some trifling swelling, the affected foot had assumed the same appearance as the other: but an abnormal amount of mobility was present at the line of articulation between the tarsus and metatarsus, which was doubtless referable to rupture of the ligaments. The foot was afterwards carefully bandaged, and the limb placed, semiflexed, on a pillow. When this treatment had been persevered in for a month, all pain and swelling had disappeared, and the patient was permitted to get up; in the course of another fortnight she was able to leave the hospital. When seen some time afterwards, the only remaining effect of this singular injury was a little lameness.

In reviewing the mode in which this accident was produced, we find that the patient slipped whilst carrying a heavy burden, and, in the instinctive effort to save herself, threw the whole superincumbent weight on the right foot. Now, under these circumstances, the leg being flexed, and the heel raised and firmly fixed by the contraction of the gastrocnemius and soleus muscles, the foot was forced to take its purchase on the ground by its anterior half only, whilst the tarsus was pressed on by the weight from above: the effect of these contending forces was, as we have seen, to produce a rupture of the ligaments, and dislocation of the metatarsus from the tarsus. The action of the peronei and tibialis anticus I regard as quite of secondary importance in the production of this effect. It seems probable that both the dorsal and plantar connecting ligaments were ruptured. In conclusion, I may remark that this case derives its chief interest, from its clearly establishing the possibility of such an accident as that detailed; and moreover that its occurrence is not necessarily complicated by any other serious mischief. It also demonstrates the simplicity of the diagnosis, as well as the facility of the reduction: and lastly, we learn the importance of speedily restoring the dislocated bones to their normal position, before the attempt is rendered abortive by inflammation and its effects.

Case II. *Dislocation of the metatarsus on the tarsus, affecting both feet at once.*—Paul Eudes, aged 24, a hosier, fell, whilst drunk, into a ditch six feet deep, and alighted on the soles of his feet. This accident was succeeded by great swelling and ecchymosis over the whole of each foot, in consequence of which the patient was obliged to keep his bed for three weeks, and applied camphorated spirits to the affected parts; at the end of that time he found he could only walk with great difficulty and pain, and accordingly came to the Hôtel-Dieu: this occurred in 1825.

On admission, the natural convexity of the dorsum of each foot was augmented, but more remarkably so on the left side; and in conjunction with this there was a corresponding diminution in the length of the feet. These conditions the patient had perceived, as he had been obliged to slit up that part of the shoe which corresponds to the instep; and he had also observed that his toes did not extend so far, by one inch, towards the extremity of his shoes as they did before the accident. In walking, he experienced pain at the middle part of the inner border of the foot; and he was obliged, in order to relieve himself, to bring the heel to the ground first: he also found it much more difficult to go down stairs than up; but when in bed he was free from pain.

About the centre of the dorsal aspect of the feet, a slightly curved line was very perceptible, the convexity of which faced forwards, whilst its direction was oblique from within outwards: this was due to the prominence of the metatarsus; for, on measuring the distance between the inner extremity of this prominence and the first metatarso-phalangeal articulation, it was found to correspond in length to the first metatarsal bone in the skeleton; and further, the outer extremity of the ridge in question abutted on the tuberosity of the fifth metatars bone, and its regularity was interrupted opposite the base of the long metatarsal bone of the second toe. As I have already remarked, the displacement was much more marked on the left than on the right side; indeed, so great was it in the former, that there was sufficient room to lodge the index-finger behind the third and forth metatarsal bones: but this could not be effected, even by pressure, with the first and second, whence I concluded that the dislocation was incomplete at these points; and the displacement was very trivial indeed between the fifth metatarsal bone and the cuboid. The flexor tendons of the toes were rendered a little tense.

After the patient was admitted into the Hôtel-Dieu, several fruitless attempts were made to accomplish the reduction: I therefore substituted a permanent compress on the displaced bones, employing a thick leather sole which exactly fitted the plantar surface of the feet, except at a line opposite the posterior border of the metatarsus, where it was hollowed transversely. Some graduated compresses were also applied on the prominence of the metatarsus above, and the whole confined by a bandage. The sensible diminution of the deformity from this treatment, was very trifling, and the patient consequently left the hospital at the end of a fortnight.

In summing up the principal signs characterizing dislocation of the metatarsus, we find them to be the following. The foot is shortened; the bases of the metatarsal bones present a prominent ridge along the dorsum of the foot, and behind this there is a corresponding depression: lastly, the concave arch of the foot is rendered flat by the presence of the tarsal bones, which are thrown beneath the metatarsus. The explanation which I have already given of the mode in which the dislocation was produced in the first case, will suffice also to account for the direction in which the metatarsus was forced, in both instances, from its normal position. The latter case likewise illustrates the importance of an early reduction, especially as contrasted with the former. It is unnecessary that I should repeat the instructions for effecting the reduction: but I may impress upon my readers the great importance of perfect repose, and for a lengthened period, to allow the distended and ruptured ligaments the opportunity of recovering fresh attachments and a healthy condition.

CHAPTER XVI.

FRACTURE OF THE MASTOID PROCESS.

Amongst the bones which seem likely to escape injury from external violence, in consequence of their position, their depth, and the protection they derive from surrounding parts, there are few that can be compared with the mastoid process. Neither a fall nor a blow can produce fracture of this bone, not only for the above-mentioned reasons, but further because it presents too small a surface. The following singular instance of this injury is one of the many cases of gun-shot wounds which it has fallen to my lot to witness.

After the disastrous events of 1814, wounded men of every nation crowded to the Hôtel-Dieu, and amongst them a young Bavarian who had a fracture through the base of the right mastoid process. The bullet, which caused the wound, entered anteriorly, and passed obliquely backwards and towards the left side, perforating in its course the right concha, the base of the corresponding mastoid process and the muscles behind it, and ultimately made its exit near the outer border of the splenius. On introducing a probe it was soon ascertained, notwithstanding the swelling and confusion of the parts implicated, that the apex of the apophysis was separated from its base, and that it was drawn downward and forward by the sterno-mastoid muscle, the amount of displacement being increased or diminished as the head and chin were moved to the left or to the right. The posterior opening was freely enlarged, which, however, did not prevent inflammation, accompanied by considerable fever and irritation of the primæ viæ: to allay these symptoms, bleeding and leeches were had recourse to. Abundant discharge of pus took place, which flowed from the auditory canal; abscesses formed round the wound, which were opened; and the suppuration brought away some spicula, whilst others were extracted with a pair of forceps. Towards the close of the first month the inflammation gradually subsided, and soon afterwards the discharge decreased; but the extremity of the apophysis was still drawn down, and detached from its normal connexion by the action of the sterno-mastoid muscle. An apparatus was then employed, consisting of a body-bandage fastened round the chest beneath the arms, a roller round the forehead, temples, and occiput, and a broad tape; which latter was firmly fixed beneath the folds of the roller, but free below the right temple, and attached to the anterior part of the body-bandage; thus, being placed on the head from left to right, it forced the head to the right side, at the same time that it gave the chin a downward inclination to the left. In this position the head remained for a month or six weeks, the sterno-mastoid muscle being relaxed, and the fragment of the process in proper position. After a time the suppuration diminished, and some spicula came away; and in about two months and a half the wounds were healed, and there was ossific union of the apex of the apophysis to its base. The bandage was then removed, no further displacement took place, and the patient left the country cured.

I know of no parallel case of fracture of this bone, and I believe it could only be produced by a body passing through it; as the conoidal shape of the apophysis and the breadth of its base must enable it to resist every action of the sterno-mastoid, which is the only muscle that can tend to fracture it: and, on the other hand, its protected position prevents extraneous causes, such as blows or falls, from acting conjointly with the muscles, as they may in fractures of the patella and olecranon.

It is possible also for a bullet to lodge in the mastoid process, of which the following is an instance. Jean Moreau, a dragoon, aged 23, was hit, on the 17th of June, 1815, by a ball discharged at no great distance, which pierced the external ear and penetrated as far as the mastoid process. Being sent to Paris, he was admitted into the Hôtel-Dieu nine days after he received the wound. The position of the ball was easily detected by the aid of a probe, and after a few attempts it was extracted, and the patient left the hospital on the following day.

CHAPTER XVII.

FRACTURES OF THE ZYGOMATIC ARCH.

Considering the position of the zygomatic arch, which connects as a bridge the head and face, and presents a slender subcutaneous prominence behind the cheek, it is matter of surprise that it is not more frequently fractured. Its arched form, its elasticity, and the support it derives from the subjacent soft parts, are probably the chief causes of the rarity of this accident; not that it is removed entirely from the operation of external agents, as is proved by the opportunities offered from time to time of witnessing instances of this fracture in the hospitals. Blows or falls on the zygoma are the usual causes of this injury. If the violence is moderate, the elasticity of the arch enables it to escape without fracture; but if considerable, then it yields from within outwards, and the irregular fragments, being driven inwards, rest against each other so as to prevent the arch from resuming its natural form; and the consequence is a depression more or less marked at the seat of injury. This result is not, however, invariable, for in some cases neither wound nor depression is perceptible where the fracture exists; in other instances there may be a wound, without displacement of the fractured ends, such as may be produced by the cut of a sabre: neither of these injuries is difficult to treat, the contusion to the soft parts being generally the most troublesome part of the mischief. Two further varieties of this form of accident consist in simple or compound fracture with depression; and these I have met with most frequently. Lastly, a comminuted fracture may exist, and may be either simple or compound; in such cases the soft parts are more or less contused or lacerated, and there is ecchymosis, and a tendency to inflammation, suppuration, and the usual sequences of these conditions.

Occasionally fracture of the zygoma is complicated by the more serious mischief of concussion of the brain, or a painful shock to the other bones of the face, which effects are communicated by the connexions which the arch has severally with the cranium and face: these symptoms will even sometimes attend a blow on the part in question without concomitant fracture, as I remember to have witnessed in one instance. In these fractures there is no probability of displacement of the arch either upwards or downwards, on account of the attachment of the temporal aponeurosis to its upper border, and the origin of the masseter muscle from its lower edge.

It is not always easy, where there is no external wound, to detect this fracture through the ecchymosis and swelling which result from the accompanying contusion: in most instances there is neither mobility nor crepitus to direct the surgeon in the diagnosis; and the inequality of the surfaces, together with the depression at the seat of fracture are often so masked by the swelling, that they afford but little assistance in determining the existence of an injury which is, perhaps, not suspected. But when, on the contrary, the depression is very marked, and there is a wound of the skin, the diagnosis is comparatively simple. Be this, however, as it may, when there exist neither laceration nor wound of any sort, it is fortunately but of little moment, comparatively speaking, to determine positively the existence of this fracture: even if the depression be perpetuated it does not much signify; for the course to be pursued must be regulated by the nature of the accompanying mischief and its probable consequences, rather than by the fracture itself.

It is not practicable in these cases, as in fractures of the limbs, to operate by any mechanical power upon one or other of the fractured extremities, for the purpose of reducing them to their normal relative position; this can only be effected by the aid of instruments, similar to those which are applied to elevate depressed bone in fracture of the skull. I would not, however, be understood to advocate the employment of such means, even where the case may admit of it: for it must be remembered that the elevator is applied in fractures of the cranium, to relieve the symptoms of compression of the brain which threaten life; whereas in fracture of the zygoma with depression we should but seek to remove a deformity, and the risk of the operation would be greater than the advantage which would be likely to accrue. Indeed, the operation of introducing an elevator beneath the zygomatic arch would involve an incision through the integuments, perhaps also through the temporal aponeurosis, or even through the masseter muscle: and it is not very easy to foretell what amount of mischief might follow such free use of the knife. I have never seen but one case in which such a mode of treatment was admissible.

Case I. *Fracture with depression of the zygomatic process; elevation of the fragments, and cure.*—A carpenter, who had fallen from a scaffolding, was struck on the right cheek by a piece of wood, which cut its way through the soft parts and fractured the zygomatic arch at several points, forcing the fragments so deeply into the substance of the temporal muscle, that it was absolutely necessary to elevate them, in order to anticipate the serious consequences which might otherwise have ensued. Fortunately the division of the soft parts at the time of the accident rendered the introduction of an elevator beneath the depressed fragments comparatively simple and void of additional risk: they were raised, though not without some little difficulty: inflammation followed, the result of the accident rather than of the operation; collections of matter formed along the coronoid process and burst into the mouth: but the patient was cured at the expiration of six weeks, without deformity or any difficulty in moving the jaw; and not a single spiculum of bone was discharged during the treatment.

In cases where there is neither wound nor other serious complication attendant upon depression of the bone, it is sufficient to employ a general and local antiphlogistic treatment; and when the swelling arising from the ecchymosis, and the inflammation are dissipated, the amount of displacement becomes apparent: but the deformity and interference with the function of the parts is generally so trifling, as to be a matter of indifference alike to the patient and surgeon.

Case II. *Fracture of the zygomatic arch; death, and autopsy.*

—Claude Ducrot, aged 70, of feeble constitution, was knocked down by a coach in 1808, and was brought to the Hôtel-Dieu in a state of unconsciousness. As the only perceptible injury was a small wound at the external angle of the right eye, the house-surgeon attributed the symptoms under which the patient was labouring to severe concussion of the brain; for he continued insensible and motionless. At my evening visit I detected fracture of the zygoma, and ordered venesection, purgative injections, an emetic, and blisters to the legs. The patient did not, however, rally, but died on the fifth day after the accident.

Autopsy.—The examination of the seat of injury demonstrated the existence of a fracture through the zygomatic arch, and that part of the superior maxillary bone which constitutes the antrum was driven in; but neither the membranes nor structure of the brain presented any abnormal appearance.

CHAPTER XVIII.

ON DISLOCATIONS OF THE VERTEBRÆ, AND DISEASES WHICH RESEMBLE THEM; TOGETHER WITH MEDICO-LEGAL CONSIDERATIONS ON THESE DISPLACEMENTS. ON FRACTURES OF THE VERTEBRAL COLUMN.

THE articulations of the vertebræ, which occupy the lowest position in the scale of movable articulations, in consequence of the limited amount of motion allowed of and the character of their connexions, have always appeared very little obnoxious to those dislocations which are of such frequent occurrence in joints admitting of more extended motion: indeed, with the exception of such displacement between the first and second cervical vertebræ, this form of injury has been either overlooked or positively denied by most writers on the subject. It is true that several old authors have spoken of this accident; but, as the cases they relate are not supported nor verified by post-mortem examinations, their opinions are next to valueless: it is by pathological anatomy alone that we are enabled properly to associate the causes and effects of morbid actions; and the cultivation of this science has afforded satisfactory evidence of the existence of these displacements.

It must be admitted that the number and strength of the ligaments which unite the vertebræ together, the almost vertical or slightly oblique facing of their articular processes, and the mode in which they lock into each other, together with the extended surface by which their bodies are connected, and the small amount of motion admitted of between any two,—I say, it must be admitted that all these points combined necessarily render dislocation very difficult: but when we superadd the comparative facility with which the bodies of the vertebræ give way by fracture under external violence, one almost ceases to be surprised at the scepticism manifested by most modern writers, regarding the feasibility of simple luxation.

The relative arrangement of the articular processes no doubt constitutes the chief obstacle to dislocation of the vertebræ; yet, though these apophyses are usually fractured in such cases, the third remarkable case which I shall cite will prove that this is not a necessary concomitant of the former lesion.

These reflexions are especially applicable to the dorsal region of the spine, and even still more so to the lumbar region, the bodies of which are much larger than those of the others, and the articular processes are elongated vertically, that is, in the direction in which the greatest amount of motion is admitted of. Thus, most authors set down dislocations produced by violence applied in various ways, and characterized by abrupt curvature, paralysis, &c., as fractures occurring in these regions.

But if writers reject dislocations of the bodies of the vertebræ as impossible, they admit those of the articular processes, and particularly of the atlas and axis. In order to have a just idea of the mechanism of this last luxation, I will make a few observations on the connexion between the two vertebræ which it affects. Their opposed articulating surfaces are broad and nearly plane; and a transverse ligament completes the ring in which the odontoid process is lodged and moves. Now, this arrangement, and the lax nature of the capsules would subject these vertebræ to frequent displacement, were it not for the existence of two lateral (moderator) ligaments, and the strong perpendicular ligaments, which extend upwards to the basilar process. These constitute the strength of the articulation, and limit the motion which is admitted of between the first two vertebræ.

Dislocation of the atlas from the axis may be produced during violent flexion of the head; or may be the effect of forced rotation. As laceration or compression of the spinal cord by the odontoid process or even the body of the axis always accompanies this accident, it is immediately fatal, and entirely beyond the resources of our art. The instances of recovery from this injury which are narrated in some books, were at most but cases of dislocation of the articular processes lower down in the cervical region.

Dislocation of the other cervical vertebræ is usually limited to one of the oblique processes: it is often the consequence of a rapid revolution of the head in looking backwards. It may also result in children from a summerset on the head; so that the neck, being too weak to bear the weight of the body, is at once bent forwards and to one side,—a necessary condition for the production of this form of dislocation.

The attempt to reduce these dislocations is attended with great risk, patients often perishing from the compression or stretching of the spinal cord, which the experiment necessarily involves. Petit Radel mentions having witnessed such a case in a child. In the present day these cases are usually not meddled with: the pain gradually subsides, but the distorted position of the head is never recovered from.[1]

The foregoing remarks will tend to facilitate the comprehension of those peculiarities which characterize false luxations, of which I shall narrate several instances by and by; and I now proceed to detail some cases illustrative of dislocation as affecting the bodies of the vertebræ.

Case I. *Laceration of the ligaments connecting the bodies of the cervical vertebræ, without displacement; terminating fatally.*—A man, about 50 years of age, was waiting at the back of a cart, with his body braced up and his head and neck bowed forwards, prepared to receive a quarter of beef upon his back; when the burden, escaping from the hands of the person who was about to load him, fell with force upon the butcher's neck and knocked him down. He was immediately conveyed to the Hôtel-Dieu, where I saw him on the following day, utterly deprived of (voluntary) power and sensation in the lower parts of the body.

The back part of the inferior cervical region was tender when touched or on the slightest movement, and presented a large patch of ecchymosis without swelling: at this spot there was manifest crepitus when the patient's head was turned or raised. Sensation and (voluntary) motion were extinct in the arms, in the parietes of the chest and abdomen, and in the lower extremities: there was also retention of the urine. The diaphragm, and muscles of the neck and face alone contracted; respiration was laboured, but the voice was scarcely at all affected.

---

[1] This negative practice is not universally recommended: and the cases cited by Seifert prove that reduction may be satisfactorily accomplished. (Rust's Mag. vol. xxxiv, p. 419.)

For two or three days there was no alteration in the symptoms; but after this the dyspnœa suddenly became more urgent, the pulse irregular, the eyes prominent, and the skin red and livid: in short, the patient sank with all the symptoms of absolute suffocation.

On opening the body, a very large ecchymosis was found surrounding the lower cervical vertebræ: the intervertebral fibro-cartilage between the fifth and sixth was completely torn through, but their bodies were uninjured. The spinous, transverse, and articular processes of the fifth, sixth, and seventh cervical vertebræ were broken; and the amount of lesion was such as to permit the upper part of the spinal column to be moved backwards and forwards on the lower. Yet, in spite of this surrounding disturbance, the spinal marrow at first sight appeared uninjured, being only a little more voluminous than natural: but when a longitudinal section was made, its substance was found broken down and entirely disorganized in the interior, and mixed with decomposed blood.

Case II. *Laceration of the vertebral ligaments with displacement, terminating fatally.* — A man, from 40 to 45 years of age, whilst working in the quarries, was crushed by the falling in of a mass of earth upon his loins, when he was in the act of bending forwards. He was carried home, where he remained for three days, deprived of motion and sensation in the lower parts of the body, and was then brought to the Hôtel-Dieu. The upper part of the lumbar region then presented a large tumour, soft at its circumference, but hard and raised in the centre, where crepitus was distinctly perceptible. A second tumour could be distinguished through the abdominal parietes, which was uniformly firm, and situated opposite the spine, having its long axis corresponding to that of this column. The longitudinal extent of the abdomen was evidently diminished, the base of the thorax almost touching the crests of the ilia. There was at the same time entire loss of (voluntary) motion and sensation in the lower extremities and abdominal parietes; the urine dribbled away from the distended bladder, and the fæces were retained. The belly was tumid but soft; the pulse small and contracted, and the respiration short and laboured. The patient complained of dull pains in the dorsal region; the intellectual faculties were unaffected.

The two tumours, the crepitus, the altered relation of the chest and pelvis, together with the other general symptoms, left no doubt that there was fracture of the spine with displacement.

On the sixth day after the accident, the left arm was involved in the paralysis, and the movements of the right had become slow and uncertain: on the seventh the respiratory acts were performed by the diaphragm alone, and the patient soon afterwards died asphyxiated, from the progressive interruption of the mechanical and chemical phenomena attending this vital function.

When the body was examined, the transverse and oblique processes of the last dorsal and first two lumbar vertebræ were found broken. The body of the last dorsal and that of the first lumbar, separated from their apophyses and from the body of the second lumbar, had slipped in front of this latter, and projected forwards more than an inch. The spinal marrow was lacerated, and the pillars of the diaphragm were torn: blood was extravasated around the whole of the vertebral column at these points. A more careful examination of the displaced vertebræ discovered, not a fracture of the body of either but, laceration of the intervertebral substance, which at one small point only had torn away a small fragment of the bone which adhered to it.

CASE III. *Simple dislocation without fracture, terminating fatally.*—A woman, aged 56, tall and very stout, fell backwards in descending a staircase, and struck the lower and back part of her neck violently against the edge of one of the steps. She was taken up, after falling twenty steps lower, deprived of (voluntary) motion and sensation in almost every part below the neck. The night was passed in great suffering in the injured part: the patient also complained of a burning thirst, and the bowels were unrelieved.

On the following morning she was brought to the Hôtel-Dieu, with the symptoms unmitigated, and the pain was increased on pressure. The head and neck were inclined forwards and a little to the right side, the back part of the cervical region of the spine being depressed, and the upper part of the dorsal projecting. Although sensation and voluntary motion were entirely annihilated below the diaphragm, the paralysis of the upper extremities was incomplete: respiration was frequent and laborious, but the voice, the senses and intellect were not affected. The pulse was full and soft, the tongue dry and brownish, and the skin natural. The diagnosis, with these symptoms, was easily made.

The patient was bled from the arm, which seemed to abate the thirst and dyspnœa for a time; but on the following night the breathing became stertorous, articulation indistinct, the face livid and swollen; and she died thirty-four hours after the accident, the intellect remaining undisturbed till the close.

On examining the body, the back part of the neck was found bruised, the areolar tissue and subjacent muscles being bathed in blood. The textures immediately surrounding the vertebræ were destroyed, and left exposed the articular processes of the seventh cervical, from which the sixth had been thrown forwards about half an inch. In the interval between these two vertebræ the spinal marrow was seen, stretched from behind forwards and from above downwards, flattened and compressed on the body of the seventh cervical.

When examined in front, the spine presented a remarkable prominence of the entire body of the sixth cervical vertebra, which was covered with blood: the common anterior ligament was torn through, and the pharynx lacerated. On further examination the ligamenta subflava and other ligaments, including the intervertebral substance, connecting the sixth and seventh cervical vertebræ had given way; two thirds of the fibro-cartilage adhering to the latter, and one third remaining attached to the former, of these bones. The only fractures which could be discovered were of the extremity of the spinous process and the edge of the lower articular processes belonging to the sixth cervical. The only other point which attracted attention was, the existence of an unnatural degree of mobility between the last vertebra of the neck and the first of the back.

Of these three cases the first presents an example of laceration of all the vertebral ligaments and fracture of the articular processes, without dislocation; the second is an instance of the same injury followed by dislocation; and the third is one of simple dislocation, without any fracture worth mentioning of these bones.

In all of these cases a blow was inflicted on the back of the vertebral column whilst in a state of tension: in each the intervertebral substance was torn, whilst the bodies of the vertebræ remained uninjured; but in the first two, the spinous, transverse, and articular processes were broken and separated from the bodies, with the exception of the last, in which all these apophyses were intact. In the first case, again, the force applied was apparently insufficient to produce displacement; whereas, in the second, it caused rupture of the ligaments, fracture of the apophyses, and extensive displacement at the thickest part of the vertebral column. Lastly, in the third case, a similar effect was produced, the articular processes of one vertebra gliding over those of the other.

In all three cases, it was the lesion of the spinal marrow which constituted the all-important symptom of the accident, accompanied as it was by entire paralysis below the seat of injury: and in each this affection extended speedily upwards, until it involved the origin of the phrenic nerves, and thus terminated life by interrupting and ultimately arresting respiration. A fatal result always (and immediately) follows compression of the spinal cord above the origin of the phrenic nerves, but life may be more or less prolonged, when the injury takes place below this spot.

The preceding cases clearly prove the possibility of one vertebra being dislocated from another; and in the museums of the Ecole de Médecine and Jardin-des-Plantes there are other preparations confirmatory of this fact. The following three cases may also be cited as illustrative of the subject under consideration.[1]

CASE IV. *Dislocation in the cervical region, with complete laceration of the spinal marrow.*—Henri, a mason, aged 49, fell backwards down stairs, whilst loaded with two sacks of plaster, one of which struck his breast, whilst his head rested on one of the stairs. He was stunned, but when admitted into the hospital, the lower extremities were not paralysed. When seen in the evening, his head was continually bent forwards and to the right side, and it could not be rotated towards the left. The spinous processes of the last two cervical vertebræ were very prominent; and above this there was a depression which rendered it impracticable to feel the spines of the fourth and fifth. To the left of this depression was another prominence, which, it was presumed, was produced by the transverse processes of these last-named vertebræ. There was at this time entire paralysis of the lower part of the body, and the respiration was purely phrenic. This patient died quietly ten hours after the accident.

---

[1] [These cases are subjoined by the editors of the 'Leçons Orales;' an abstract of them is all that is deemed essential, as every large museum now contains illustrations of the mooted point.—TR.]

When the body was examined, a dislocation of the fifth from the sixth cervical vertebra was found, the former being forced forwards; yet the bodies of neither were broken. The intervening fibro-cartilage was of course torn through; but the only fracture was that of the points of the transverse processes of the fourth and fifth vertebræ. The spinal marrow was torn through at the seat of dislocation.

Case V. *Dislocation of the sixth cervical vertebra.*—Courtois, quarter-master of a brig of war, aged 42, was bathing in the sea, with a sail spread to keep off the sharks; and in plunging head foremost, he came in contact with the sail, and was taken on board, with paralysis and all the symptoms of compressed spinal cord, below the neck; he died on the seventh day.

On examining the body, the inferior articular processes of the sixth cervical vertebra were found dislocated, and there was rupture of the corresponding fibro-cartilage, with laceration of the common anterior and elastic ligaments: the body of the sixth cervical projected forwards. The spinal cord was compressed, softened, and injected.

Case VI. *Dislocation forwards of the body and articular processes of the fifth cervical vertebra.* — François Chazot, aged 41, of athletic frame, was at his occupation as a sawyer in the pit, when the plank which was being cut fell in, and struck him principally on the back of the neck. He was taken up, being unable to move, and at once conveyed to the Hôtel-Dieu.

When visited he was lying perfectly still, with his head inclined forwards: there were some slight bruises about the shoulders, and he complained of indistinct pains about the posterior cervical region; these were aggravated on pressure or movement of the head forwards. Every part below the breast was deprived of sensibility and power of motion, with the exception of the disphragm, by which respiration was exclusively carried on. The pulse was full and strong; and the voice was natural, but could not be raised beyond the ordinary pitch of conversation. I ordered him to be bled, but very little blood could be obtained, probably from the want of muscular action to accelerate the flow through the veins. This patient sank quietly, and died at the expiration of twenty-four hours.

Autopsy.—There was a large ecchymosis at the back of the neck and behind the œsophagus. The body and articular processes of the fifth cervical vertebra were dislocated forwards from the sixth; and the upper margin of the latter was broken off towards its right side, the fractured portion adhering to the body of the fifth: the left inferior articular process of the same vertebra was also slightly fractured. The laminæ of the sixth vertebra were broken through in a vertical direction, and driven in so as almost to obliterate the spinal canal at this point: the intervertebral and most of the ligaments were torn through at the same spot. The anterior spinal muscles, the vertebral arteries and phrenic nerves were uninjured. The spinal cord was flattened, compressed, and softened.

It appears, then, that these dislocations may occur; and the symptoms which attend the accident in the cervical region are nearly uniform, the cause of death being, apparently, the upward extension of the disorganization of the spinal cord, so that the origin of the phrenic nerves is ultimately involved, and death takes place from asphyxia.

A question naturally suggests itself here as to the propriety of attempting the reduction of dislocations, such as existed in the preceding cases,—a proceeding which has been accomplished where an articular process in the cervical region was alone dislocated. This inquiry may be simply answered by the remark, that the force requisite to effect the desired object would necessarily involve the spinal cord in the extension, and would thus complete the mischief which compression had already begun. We must, therefore, reluctantly regard this injury as incurable and mortal.[1]

Having pointed out the symptoms attendant on dislocation of the vertebræ, and shown the obscurity and difficulties in which these injuries are involved, it may be not uninteresting to place side by side with the preceding cases some examples of a disease which, from its resemblance to the above, has more than once misled and deceived otherwise able practitioners.

Case VII. *Violent distension of the muscles of the right side of the neck, and of the ligaments of the upper cervical vertebræ, resembling dislocation of the atlas from the axis.*— Alexis Descamps, a publican, was admitted in 1831 into the Hôtel-Dieu, to be put under treatment for an affection which was supposed to be a dislocation between the atlas and axis, and which in fact very much resembled this accident in its symptoms. The patient gave the following account of himself.

On the previous day, he had, whilst in the act of drawing on a blouse, bent his head forcibly over his left shoulder, and was immediately seized with violent pain on the right side of the neck, and with numbness in the corresponding arm and cheek: deglutition of the saliva at the same time became very difficult. The head rested on the left shoulder, and could not be put straight, the slightest movement aggravating the pain. The numbness of the cheek and arm, however, ceased after the lapse of an hour; and after a violent effort to swallow, this difficulty was also overcome; but the head obstinately retained its abnormal position. At the hospital whither he had been first taken, the surgeon was afraid to meddle with him; and when admitted into the Hôtel-Dieu on the day after the accident, the head was still bent in this way, and the neck painful. He was unable to turn his head, without at the same time turning the whole body. The only peculiarity in the form of the neck was the convexity of the right side arising from its flexion towards the left. It was a general opinion, however, that the case was one of dislocation between the atlas and axis: but I was at once satisfied that the patient was suffering from a rheumatic affection; for I have frequently seen similar effects from analogous causes, such as spasm in the calf of the leg from dancing, and a similar affection of the dorsal muscles in any act of extension of the spine. This is especially the case in persons subject to rheumatism, and will frequently last for some days, or even leave one part to attack another. The pain, in this case, was probably due to the stretching of the muscles and fibrous structures, and the temporary numbness to tension of the cervical plexus, which communicates with both the facial and brachial plexus.

---

[1] [Even could such reduction be effected without further injury to the cord, it is reasonable to believe that there would be little or no relief to the symptoms, as illustrated in the operations for fractured spine, which have been uniformly unsuccessful. It is the lesion of the cord *at the time of the accident* which appears to be irremediable by surgical interference: perfect rest is the only chance for the patient. —Tr.]

I ordered cupping and leeches to the right side of the neck. This was afterwards followed by a blister, and the relief of the symptoms was speedy. In the course of three weeks the patient left the hospital well.

CASE VIII. *Distension and thickening of the intervertebral ligaments in the neck.*—A man was admitted into the Hôtel-Dieu for a pain in the cervical region, which he attributed to some blows he said he had received from the butt-end of a gun; but he admitted having had a fall some months previously, which had occasioned him great pain without, however, laying him up. When admitted, the neck was convex backwards, so that the spinous processes projected very much. He was unable to perform any rotatory movement of the head, which, when he wanted to look round, appeared as if it were immovably fixed to the trunk; and any unpremeditated motion was particularly painful: these symptoms had been aggravated by labour, and the vertebral ligaments had evidently undergone a morbid change. He was cupped on the neck with decided benefit: but when this operation was repeated, it had not the same good effect. Two moxas were subsequently applied to the nape of the neck, and under this treatment the patient recovered.

CASE IX. *Disease of the cervical ligaments, resembling dislocation.*—This was the case of an old man, about 60 years of age, in whom the symptoms and appearances were similar to those of the last case. The treatment was similar; and the result satisfactory: though, it should be observed, these affections are very slow in their progress, and when this report was made, the present case was still under treatment.

Case X. *Disease of the ligaments of the occiput and neighbouring vertebræ; paralysis and atrophy of the left half of the tongue.*—(The last-mentioned symptom constitutes the principal interest of this case.) A man, aged 30, a weaver by trade, was admitted into the Hôtel-Dieu, with a disease which appeared to result from a rheumatic affection, contracted in a damp cellar where he was accustomed to work. It was three years since he was first attacked with acute pain on the left side and back of the head, which precluded all movement between it and the spine, and deprived him of rest. Soon afterwards the pain became limited to the upper and left side of the neck, and though he could move the cervical spine, still the head was immovable. In the course of a short time these symptoms were succeeded by a difficulty of utterance, at first slight, but sensibly increasing, so that at the end of two months the patient could not make himself understood. There was some pain in the cheek and at the angle of the jaw, but no paralysis of the muscles of this region. Another and still more remarkable symptom now manifested itself; the tongue gradually diminished in bulk on the left side, until at length it became completely atrophied, the muscles having apparently disappeared from within their envelope of mucous membrane, especially from the centre forwards. The right side was well nourished, and appeared to possess more muscular power than natural.

When I saw this patient he had recovered (no doubt from practice) the power of articulation. In order to test his power of tasting, I performed several experiments with different substances in solution, and satisfied myself that this sense was unaffected. It appeared clear then that it was the hypoglossal or motor nerve alone that was paralysed, and this fact seemed to be confirmed by the muscles on the left side of the neck (supplied by the descending twig), partaking in a measure of the affection of the tongue: and it now remained to ascertain whether it was the nerve or brain that was primarily involved in the disease.

The pain which the patient suffered at the commencement of the attack was altogether external; the intellectual faculties were unimpaired, and the general functions of the nerves were not interfered with: even the eighth pair, which is so close to the ninth at its exit from the skull, was in no way involved.

I am therefore induced to conclude that neither division of the encephalon was the seat of the mischief; but that the lesion was in the hypoglossal nerve just after its exit from the skull: and this opinion appears to be confirmed by the disease affecting the occipito-vertebral articulation, which was of a rheumatic character, having its seat in the ligaments.

These affections are not very uncommon. There are in the collections of the School and Museum of Comparative Anatomy, ten or twelve specimens of anchylosis, with or without displacement, of the atlas to the occipital condyles. In the foregoing case, the relation of the ninth nerve to these parts, as it leaves the skull, would account for its compression or partial disorganization, at a point necessarily involving atrophy of it through its entire course and distribution.

Active treatment was adopted, as there were some symptoms of the disease being disposed to extend to the right side, though the left was improving: the fresh pain of which he complained was, however, of a mitigated character. The patient was repeatedly cupped behind the mastoid processes; and moxas were subsequently applied, the results of which were satisfactory. This is the first instance I ever witnessed of paralysis and atrophy of one half of the tongue.

Independent of the many curious and interesting points associated with dislocations of the vertebræ, as regarded in an anatomical or a surgical point of view, there are also medico-legal questions which are of sufficient importance to demand investigation and attention. Thus, violent extension of the neck of a child, or of a feeble or intoxicated person may occasion death. Indeed, instances are recorded in which the first vertebra has been dislocated from the second, in consequence of lifting young children by the head. Again, might it not be practicable to produce this dislocation in the dead subject, for the purpose of leading public opinion astray, or otherwise defeating the ends of justice? It is clear that no conclusion can be deduced from the state of the skin, or of the head or face, of a sufficiently definite character to be considered satisfactory in cases of difficulty and importance.

With a view to resolving these doubts, M. Richond[1] had recourse to a series of experiments on dogs and cats, in which he strangled them, divided the spinal marrow, or twisted their necks. From these researches he inferred that, where the lesion of the cord between the first and second vertebræ was such as to entail instant death, there was the same congested state of the viscera as in death from suffocation; the brain being sometimes injected, the skin discoloured, the eyes sunken, &c.

But there are two other questions which demand attention, namely, whether the dislocation found on a dead body was effected during life or after death; and again, whether it was done accidentally or intentionally.

For the purpose of solving the former important question, it is requisite to examine the displaced parts with the utmost care, as well, indeed, as the neighbouring textures and internal organs. Attention must likewise be paid to the position of the body, its stiffness or flexibility, and the colour of the skin, as well as many other circumstances which cannot be foreseen.

Dislocation of the first vertebra on the second may be produced by the head being forced downwards, or violently twisted round, or by hanging. When the result of the first mode, there is rupture of the transverse ligament or the odontoid process is broken, and compression or laceration of the spinal marrow is the consequence. The odontoid ligaments may also be ruptured, but sometimes they are only stretched. In this form of dislocation, as well as in that from hanging, the head may be moved about very freely.

When dislocation is caused by the head being twisted or excessively rotated, one of the odontoid ligaments is ruptured, and the displaced articular surfaces, instead of being one on the other, are on the same plane. In these cases the movements are usually limited on the sides.

---

[1] Considérations médico-légales sur les luxations de la première vertèbre cervicale sur la seconde; par L. Richond. Paris, 1822.

With respect to the condition of the surrounding parts, there are certain points which serve importantly to elucidate the subject: thus, if the dislocation had been effected during life, there would be extravasation of blood into the filamentous tissue, by the rupture of small vessels; and the spinal cord would be more or less injured. It is true that if the neck had been dislocated very soon after death, there would still be blood effused; but then it would remain fluid, or only present small clots possessing but little tenacity.

Apoplexy might, by possibility, produce dislocation,[1] but an inspection of the organs contained in the three cavities would determine the cause of death. If the accident were to follow asphyxia, the lividity of the face, and the condition of the eyes and tongue would serve to clear up the doubt.

In so delicate a question as that we are discussing, not one symptom, however trivial, should be left out of the account: thus the position of the corpse may throw an important light on the subject. As soon as the spinal marrow is compressed,[2] the muscles become paralysed and relaxed, as is seen in animals in the slaughter-houses. The celebrated Louis ascertained from the Paris hangman, that he could cause very speedy death by twisting the body round when the head was fixed: and that life was extinct when a remarkable flaccidity succeeded the general rigidity; the limbs could then be freely moved about in every direction. It was in that case evident that death was caused by dislocation. When, therefore, the position of a corpse is such as to necessitate, for its persistence, considerable muscular (tension or) rigidity, which could not have been communicated after death, one may be justified in concluding either that there is no dislocation, or that, if such exist, it was effected after life was extinct.

The state of rigidity or flexibility of the body is also a proper subject of observation. When death has been occasioned by a fatal impression on the nervous system, rigidity comes on at a later period, and is more transient than in death from other causes. On this principle, if marked rigidity accompanied by heat are observed a short time after life has become extinct, we may fairly conclude that dislocation (between the first and second vertebræ) was not the cause of death. The colour of the body may also assist in determining whether this same lesion was effected during life, as, in such case, the discoloration of the skin would be very apparent.

---

[1] [It is to be presumed the author means by a fall.—Tr.]

[2] [Or, more strictly speaking, broken down.—Tr.]

To sum up then,—the principal evidence in favour of the dislocation referred to having occurred during life is, discoloration of the face, dulness of the eyes, general paralysis (muscular relaxation), congestion of internal organs, especially of the heart and lungs; considerable ecchymosis and tumefaction in the neighbourhood of the luxated vertebra. The absence of these signs of course constitutes negative evidence that the injury was effected after death.

The difficulties which surround the question of homicide are still more embarrassing; yet science may throw some light even on this perplexing subject.

The component parts of the vertebral column are so firmly knit together, that great violence alone can separate them: to these lesions, therefore, as well as to contusions of the head it is easy to attach their due value; yet conclusions must not be too hastily drawn from them. The position of the body and the locality in which it is found are important elements in an investigation of this sort: thus, where the position is such as could not be determined after death, homicide is improbable; whereas, if a body be discovered with dislocation of the neck, from the head being bent forwards, it is evident that such mode of taking away life must have been the work of the assassin.

Again, suppose a body to be found hanging by the neck, which is dislocated, it is first necessary to ascertain whether death was thus caused, or whether suspension was resorted to as a cloak to crime: in the latter case, the absence of redness and excoriation about the part exposed to the rope would betray the truth. But death may have been occasioned by hanging, and still a question may arise as to whether the case is one of suicide or homicide. Where the body is heavy and muscular, the ligaments relaxed, the face discoloured, the eyes dull, the limbs loose, the other vertebræ unbroken, and the ternal organs in a state of congestion, suicide is probable. t if, on the contrary, the spine has been extensively injured, and the trachea lacerated, if the face is livid, and the eyes and tongue are injected, it is pretty certain that dislocation occurred after asphyxia, and that it was the consequence of violence used to accelerate death by the hand of the homicide. Here, however, we are trenching upon the province of the coroner.

FRACTURES OF THE VERTEBRÆ.

The rarity of these fractures, their serious nature, the few that are cured, together with the important functions of the spinal cord, impart an interest to these injuries which renders them deserving of the illustration which the following cases afford.

Case I. *Fracture of the sixth cervical vertebra, terminating fatally on the forty-fifth day.*—L., aged 29, of an extremely spare habit of body, fell ten or twelve feet, and encountered, before she reached the ground, an open door, against the edge of which she struck her chest violently. When her neighbours went to her assistance, they found her perfectly sensible but motionless: she at first complained of pain in the chest, but soon seemed to forget this in the acute suffering which the slightest movement occasioned in the neck. She at the same time remarked that she had lost all feeling in the thighs; but one of the persons present affirmed that for a short time she was able to move the right leg.

The patient was immediately conveyed to the Hôtel-Dieu, where the first thing which attracted attention was a large wound over the middle of the occiput, at which point the periosteum was stripped off the bone: as reaction had not taken place, the insensible and motionless state of the limbs was attributed to the injury of the head.

Some hours afterwards the state of the pulse permitted venesection; but on the following day there was no amendment of the symptoms, all the limbs being involved in the loss of power, whilst the lower were entirely motionless and likewise insensible: this, it was still thought, might be the effect of the injury to the ligamentous connexions of the spine, which was likely to have occurred from the nature of the fall. As there was a full pulse, with hot skin and great thirst, the patient was again bled, and leeches were applied to the mastoid processes, &c. As the bladder and rectum[1] were paralysed, it was necessary to draw off the water.

The continuance of the paralytic condition led to the suspicion that the spine was injured at its lower part; and thirty leeches were accordingly applied to the sacrum. The arms could be slowly raised, but the left appeared the weaker. The respiration was entirely abdominal; and the insensibility extended to within four inches of the base of the sternum, where the line of demarcation was accurately defined.

When I saw the patient on the fourth day, I was of opinion that the spine and cord were injured at the lower part of the cervical region, and that death would ensue from asphyxia, when the lesion extended upwards to the origin of the phrenic nerves. I ordered twenty more leeches to the neck. On the following day these were repeated, but without effect. On the seventh day she complained of a sensation of weight at the chest, and the loss of power in the arms became more decided. On the fifteenth, the urine was mixed with mucus, in spite of attention to the frequent evacuation of the bladder: and a slough was found on the centre of the sacrum, as large as a crown-piece.

On the twenty-first day the wound of the head was entirely healed; but the respiration had become more laboured. The patient complained of a pricking sensation at the upper part of the arm: she was also attacked with a sensation of suffocation when she dozed off, and the slough had extended.

On the twenty-eighth day the condition was much the same, with the exception of a slight increase of power in the upper extremities, and, at times, some improvement in the respiration. Up to the thirty-fifth day, there was no farther change; and she dared not sleep on account of the threatening suffocation.

---

[1] [In these cases the bladder is paralysed, because the detrusor urinæ is a voluntary muscle: the rectum, however, retains its peristaltic power, because it is under the control of the cyclo-ganglionic system of nerves: the sphincter ani likewise is not relaxed, as it is under the influence of the true spinal centre; and the fæces are passed unconsciously in consequence of the peristaltic *vis a tergo* overcoming the resistance of the sphincter.—Tr.]

From this time, however, the patient gradually sank, and died from an attack of suffocation on the forty-fifth day.

Autopsy, twenty-four hours after death.—There was no rigidity of the muscles, but the discoloration of the surface was general. The brain was extremely soft, and there was serous infiltration of the membranes. The spinous process of the sixth cervical vertebra was abnormally prominent; and at the corresponding point anteriorly was an angular depression, opposite the body of the same vertebra. This angle was in part filled by recent ossific deposit. The sixth vertebra, of which the anterior and inferior portion was crushed, had been divided in two by a vertical fissure: the cartilages above and below had been partly torn through, and the left lamina was broken.

State of the callus, forty-five days after the fracture.—The small fragments of bone, resulting from the comminuted fracture of the body of the vertebra, had disappeared, the remainder of the vertebra resting upon the fibro-cartilage between it and the seventh: hence the prominence and depression already noticed. The fractured surface and corresponding part of the fibro-cartilage was covered by a greyish cellulo-fungous substance, which constituted a feeble bond of union between them. In front of the fifth, sixth and seventh vertebræ and their intervening fibro-cartilages, but beneath the anterior ligament, a bed of fibro-filamentous and fungous tissue was developed. In the centre of this a small osseous mass was deposited, which was in the form of an arch and adhered to the fibro-cartilage between the sixth and seventh vertebræ, but was entirely isolated from the bodies of the vertebræ themselves: that of the former was indeed quite denuded. There was a similar fibro-filamentous deposit adhering, within the canal, to the common posterior ligament and dura mater; but there was no deposit of bone in this. There was no attempt at reparation of the fractured lamina.

The spinal cord was flattened to the extent of four lines opposite the angle between the sixth and seventh cervical vertebræ: it was sensibly softened at the same point, and of a pink hue, except at the line of strangulation, where it was yellow. The rest of the cord, as well as the membranes, above and below the seat of pressure, were perfectly healthy in appearance.

The heart and lungs were gorged with black blood; and the mucous membrane of the bladder appeared thickened; otherwise there was nothing particularly worthy of attention in the thoracic and abdominal viscera.

The chief interest in this case consists in the demonstration of the susceptibility to gangrene evinced by parts deprived of sensibility and mobility; and also in the fact of respiration being carried on for so long a period exclusively by the diaphragm.[1]

As instances of complete cure after fracture of the vertebral column are rare, the two following are worth placing on record.

Case II. *Fracture of the vertebral column, with symptoms of compression of the cord; completely cured.*—Jean Marie L., a mason, of sanguineous temperament, robust and strong, aged 28, was admitted into the Hôtel-Dieu, September 3d, 1829, having fallen, a week previously, from a considerable height, and fractured his spine at about the tenth dorsal vertebra. He had been bled four times before admission.

He was stunned at the moment of the accident, but soon recovered; and paralysis of the left lower extremity, indicating compression of the cord, did not supervene till two days had elapsed: inflammatory symptoms then set in, to combat which the bleeding had been directed. He was again blooded when admitted.

The fracture was recognized by the prominence and curvature of the lower dorsal vertebræ, which presented a convexity towards the right side. There was no attempt made to discover crepitus. Paralysis of the left lower extremity was the only symptom of compression of the cord: but in this limb both sensibility and voluntary power were lost. He was confined in a horizontal posture by a folded sheet being carried across his chest and made fast to the bed; and a pillow was placed beneath the loins.

Cerebral symptoms shortly afterwards made their appearance, for which he was again bled and leeched; and subsequently he was cupped near to the seat of fracture. On the fourth day after admission the constitutional excitement subsided, but the paralysis continued. The rectum and bladder acted naturally. Cupping was again ordered near to the site of fracture.

---

[1] [The author dwells on the fact that both inspiration and expiration were carried on by the diaphragm; whence it is inferred that, as the abdominal muscles were paralysed, this muscle "is incontestably proved to be an expirator as well as inspirator." The passive power of elasticity of the thoracic parietes, by far the most important agent in ordinary expiration, has been here lost sight of.—Tr.]

From this time the patient's general state improved, and sensibility and voluntary motion soon began to return; the former more rapidly than the latter. In the middle of October there was very little difference between the two limbs, but he was still kept quiet on his back. He only complained of a little rheumatic pain about the right hip; and the bony prominence at the lower part of the dorsal region was less marked, and confined to the median line. He soon afterwards quitted the hospital well.

Case III. *Fracture of the lower part of the dorsal region.*—Catherine Bibienne, aged 28, a washerwoman, of good constitution, was leaning out of a second-floor window, when she slipped and fell into the street. The momentum of the fall was first received on the feet, but principally on the left, and was thence propagated through the flexed legs to the lower part of the back and elbows; on which parts, in fact, the weight of the body ultimately fell when she reached the ground. She remained in this position for half an hour without losing consciousness, and was then conveyed to the Hôtel-Dieu. This occurred on November 27th, 1815.

On the following day, when I saw her, she complained of her back, abdomen, and left leg. At the lower part of the dorsal region there was a considerable prominence, which appeared to be formed by the spinous processes of the last three dorsal vertebræ. The suffering in the other parts mentioned were unattended by any important corresponding lesion. Further, the right leg and thigh were deprived of mobility and sensibility; the bladder was evacuated with difficulty and pain, and the bowels did not act. The body was bandaged, and pillows placed in the bed so as to support the fractured part, the patient being of course kept in a horizontal position.

In the course of the succeeding four days, the patient was twice bled, and an infusion of arnica was prescribed: after this the pain in the back diminished, she passed her water more freely, and she began to regain sensibility in the right thigh; the foot also could be slightly moved. On the eighth day she complained of pricking sensation and painful cramps in the affected leg: these movements were perceptible to the eye and touch. The dose of arnica was increased, and the pain soon afterwards diminished: the obstinate constipation was overcome by enemata and gentle purgatives. From this time she rapidly recovered, though she did not quit the horizontal posture for nearly three months; and after the expiration of four months she began cautiously to walk alone, when she quitted the hospital.

Independently of their surgical interest, these lesions of the nervous centres constitute a valuable source of observation to the physiologist in determining the functions of their various component parts. The localization of these functions is still open to controversy; and though many facts justify the doctrine promulgated by Bell and Magendie, yet there are others which prove that the cord may be completely disorganized, without corresponding functional disturbance. Abercrombie has related a case of diffluent softening of the whole cord, from the third to the fifth dorsal vertebra, causing complete paralysis of the arms, whilst the legs retained both sensibility and mobility. In many other recorded instances of paraplegia, no trace of organic lesion could be discovered on examination of the spinal marrow after death.

CASE IV. *Fracture of the spine, cured; death following a subsequent fall.*—Charles Millié, aged 21, carman, was admitted into the Hôtel-Dieu in 1825, with paralysis of the bladder and extremities, caused by a fall on the back of the neck. The paralytic condition was more marked on the left side than on the right, and in the lower than the upper extremities. After two months and a half of entire rest, combined with blood-letting from the arm, as well as by cupping and leeches, he was convalescent, and quitted the hospital with only slight weakness in the left leg, and the head a little bowed forwards.

In spite of injunctions to be very cautious in taking exercise, he undertook a long walk, and whilst out was attacked with paralysis; he fell down, and remained in the open air all night. When conveyed to the Hôtel-Dieu on the following day, the paralytic condition was much more complete than on the former occasion, involving the lower extremities, which were entirely powerless and insensible, and also the arms from the shoulders to the hands. At the lower part of the neck there existed a pain which extended to the left shoulder: neither bladder nor rectum acted.

The patient was bled twice and the catheter passed. Some days afterwards he was affected with spasmodic contractions of the limbs and bladder, and the catheter was no longer required. A moxa was applied between the shoulders, but without benefit: the skin over the sacrum and trochanters began to slough, diarrhœa set in, and the patient sank exhausted thirty-four days after the second fall.

On examining the spine a fracture through the lower part of the body of the fourth cervical vertebra was found: it extended obliquely downwards and forwards, but the parts were prevented from being displaced by the articular processes. The left transverse and articular processes of the fifth vertebra were fractured, so as to permit the fourth to slip forward and compress the cord at this point. The intervening fibro-cartilage between the fourth and fifth vertebræ had disappeared; and along the line of fracture in front of their bodies was an osseous deposit, resembling callus; which itself presented a fissure, as if consolidation had taken place, but the parts had again yielded to violence.

Opposite the point of compression the cord exhibited an annular constriction, abrupt and well marked, and very analogous to that presented by the intestine in some cases of strangulated hernia. When incised longitudinally at this spot, the colour and consistence of the cord were found altered to a brownish hue, and the density and firmness of fibrous tissue: a small circumscribed spot, about a line in extent, was especially characterized in this way. The membranes were also more adherent here than elsewhere. It was inferred that the seat of this peculiar change was that of the original lesion, and that the above appearance constituted a true cicatrix of the spinal marrow.

The spine may likewise suffer fracture from fire-arm wounds; and when the spinous and transverse processes alone are involved, the cases generally do well, especially if the splinters of bone are removed; for which purpose it may be requisite to enlarge the external wound made by the ball.

Case V. *Fracture, from gun-shot wound, of the laminæ of the fourth and fifth cervical vertebræ, terminating fatally.*—A sergeant of the municipal guard received, in 1832, a gun-shot wound in the neck. The ball passed completely through the mass of muscle at the back of the cervical region: its point of entrance was comparatively small and circumscribed, but that of its exit larger and irregular. The patient was conscious, but had lost all sensibility below the seat of injury; and voluntary power was almost as completely annihilated, slight mobility of the lower limbs alone remaining. The bladder and rectum were likewise paralysed; and he breathed by the diaphragm alone. Death ensued in twenty-four hours.

Autopsy.—The laminæ of the fourth and fifth cervical vertebræ were found fractured, but the cord and nerves arising therefrom were uninjured. As much as a pound of blood was extravasated into the spinal canal from the upper dorsal region downwards, at the base of the brain, and over the convex surface of the hemispheres. The substance of the brain was sound.

Case VI. *Fracture of the transverse process of the second cervical vertebra from gun-shot wound, with other injuries.*—Jean François, carpenter, aged 31, was fired on from a height, and the ball entered the right nasal fossa, tearing the ala nasi, passing through the palate, and making its exit two fingers' breadth below the right mastoid process, behind the posterior border of the sterno-mastoid muscle. He bled very little at the time, and went on favorably for ten days; after which secondary hemorrhage came on, of which he ultimately died.

Autopsy.—Besides the injury done to the bones of the face, the ball had fractured in its progress the transverse process of the second cervical vertebra. On throwing some injection upwards from the aorta, it was found to escape by the vertebral artery close to the seat of fracture. In fact, at this point the vessel was inflamed, and a consecutive slough had formed, and hence the aperture by which the blood had escaped. The cord was not involved in the mischief.

Case VII. *Fracture of the twelfth dorsal vertebra.*—Julie Jovet threw herself out of a window, first alighting on her feet and then falling on her back. She was brought to the Hôtel-Dieu, but died before she could be got to bed.

Autopsy.—The body of the twelfth dorsal vertebra was split, and the left side of it broken to splinters; the spinous process also was fractured at its base. The cord was contused and torn, and blood extravasated near the fracture. The abdomen also contained a large quantity of blood derived from a rupture of the left lobe of the liver.

In commenting on the preceding three cases, it may be remarked that, in the first the loss of sensation and motion were the consequence of extravasation of blood, the result being analogous to that produced by a similar cause, when the brain is the seat of the effusion. The blood found on the hemispheres and at the base of the brain, was probably thrown out only just before life became extinct.

The second case is interesting from the source of the hemorrhage: whilst the complicated mischief in the third, leaves no room for speculation as to the cause of death.

Case VIII. *Fracture of the last two cervical vertebræ.*—Jean Toussaint, mason, aged 21, fell from a height of forty feet on to his head. He was almost immediately placed under the care of M. Blandin, when the following symptoms presented themselves. There were two contused wounds on the scalp: the intellect was slightly affected, and there was dull pain in the head; respiration was oppressed and almost exclusively phrenic; and there was deep-seated pain in the cervical region, but no ecchymosis nor trace of contusion at this point. Every part of the body below the base of the thorax was paralysed and insensible, including the bladder and rectum: there was partial priapism; the skin was hot, and the pulse quick, strong and full. The movements of the upper extremities were constrained, especially on the right side. He was bled both locally and generally, but there was no remission of the symptoms; and he died forty-eight hours after the accident.

Autopsy.—The wounds of the scalp had penetrated to the skull; the sinuses of the dura mater were gorged with blood, and there was slight serous effusion into the arachnoid cavity.

Blood was extravasated amid the muscles at the back of the neck, as well as into the cavity of the theca vertebralis in the lower cervical region. There was a comminuted fracture of the sixth and seventh cervical vertebræ; and the spinal marrow was disorganized for the space of nearly two inches opposite the seat of injury, being softened, broken down, and mingled with blood.

Case IX. *Fracture of the fifth cervical vertebra.*—Jean Echinard, a porter, aged 27, was carrying between three and four hundred-weight upon his neck and back, when he fell forwards with his head much bent upon his chest, and in the fall the load rested on the cervical part of the spine. The patient was at once conveyed to the Hôtel-Dieu with the usual symptoms of compression of the spinal cord: there were also several bruises on the head and neck, and very acute pain was complained of in the cervical region, which, however, presented no deformity. The patient lived for two days, when delirium, stertor, and tendency to suffocation supervened, in which state he died.

Autopsy.—The fifth cervical vertebra projected beyond the sixth to the extent of two lines. The right inferior oblique process of the former was fractured at its posterior margin, and forced forwards in front of that with which it articulated below. The intervertebral substance was torn, and there was fracture of the body of the fifth cervical vertebra in an oblique direction backwards and upwards, blood being extravasated between the fragments. The spinal marrow was softened.

Case X. *Fracture of the eleventh dorsal vertebra.*—Etienne Fouchet, aged 46, fell, whilst intoxicated, from the second story of a house on to a cross beam. When brought to the Hôtel-Dieu he was suffering greatly in the lumbar region, and the lower extremities and bladder were paralysed and insensible. Pulse feeble, and small. He was bled twice and had leeches applied to the sides. This patient lingered for nine days, respiration becoming more affected towards the close: before death the skin assumed a jaundiced hue, and bilious vomiting came on: suffocation closed the scene.

Autopsy.—The eleventh dorsal vertebra was fractured at its upper part, close to the fibro-cartilage between it and the tenth, a thin osseous plate being separated from its body with the same precision as if done by a saw. The main portion of the eleventh vertebra was forced behind this plate and the body of the tenth, and the corresponding oblique processes were disarticulated, the vertebral canal being contracted at this point. The spinous processes of the eleventh and twelfth vertebræ were broken off at their base: the continuity of the cord was entirely destroyed, being softened, of a yellow tint, and with reddish striæ intermingled with its substance, for a short space above and below the seat of injury.

The preceding cases present instances of injury at different parts of the spine, and prove (to a certain extent) that functional disorders of the nervous system are not uniformly in the ratio of apparent organic lesion. In all three, however, the cord was softened and broken down, and there was extravasation of blood.

Case XI. *Fracture of the first lumbar vertebra, &c.*—Charles Verhulst, aged 28, a quarryman, of athletic frame, was buried beneath a mass of earth which fell in upon him whilst at work, in 1821. He was immediately conveyed to the Hôtel-Dieu, when it was found that his radius was fractured, and that he had acute pain in the lumbar region, attended by paralysis of the bladder and lower extremities. He survived the injury eleven days.

Autopsy.—The body of the first lumbar vertebra was found fractured, and one portion of it, consisting of its whole circumference, projected backwards so as in part to obliterate the spinal canal. Between the spinous processes of this and the last dorsal vertebra was an interval large enough to introduce a finger. The medullary substance of the brain was dark, and the pia mater a little injected: the lower part of the spinal cord was of a gray colour mixed with violet, and had lost its firmness.

Case XII. *Fracture of the spine.*—Dargon, aged 37, of robust frame, was brought to the Hôtel-Dieu, in 1826, in a state of intoxication, which rendered him incapable of giving any account of the accident for which he was admitted. The whole of the body beneath the iliac spines was deprived of motion and sensation, and the bladder was likewise paralysed. There was a projection in the median line of the back at the lower dorsal region, evidently caused by displacement of one of the vertebræ, but exactly which the surrounding swelling rendered it impracticable to ascertain: the patient complained of acute pain at this point. He was repeatedly bled and leeched, which had the effect of tranquillizing the system.

About the twelfth day a slough formed on the sacrum; and about the same time the lower wall of the urethra, near the root of the penis sloughed; (a gum-elastic catheter was worn.) Three days later the scrotum began to swell: and an incision was made for its relief. But soon the right iliac region became implicated in the same mischief, and sloughed also, giving exit to a large quantity of pus. Under this discharge he sank, and died on the thirty-second day after the receipt of the injury.

Autopsy.—The eleventh dorsal vertebra was found to be fractured across, so as to divide the spinal column into two parts movable on each other. The theca was torn through at the seat of fracture, and the cord itself was broken down, of a grey colour, softened and disorganized: the pia mater was entire. The substance of the brain appeared a little more injected than natural.

In six other cases, of which an extract will suffice, analogous phenomena were observed. The first was that of a young girl who fell from a height of twelve feet on her breast. When lifted up she had lost sensibility in her lower extremities, though the right leg was not entirely paralysed: there was also a small wound on the neck. The paralysis in the lower limbs soon became complete, but some power was retained by the arms: respiration was wholly phrenic. The skin over the sacrum sloughed, and the patient died of asphyxia forty-five days after the accident.

The sixth cervical vertebra was divided into two portions by a perpendicular fracture; the left lamina was also fractured, and the neighbouring fibro-cartilage was partly broken down. The spinous process of the same vertebra projected; and there was a corresponding angular depression in front of the spinal canal, at which point the cord was flattened and appeared strangulated: its texture was softened and pink in the centre, but yellow at the circumference of the seat of injury: and at this spot the membranes were adherent.

In the second case, a machinist of the Opera fell flat upon his back from a height of fifteen feet. All the lower part of the body was paralysed as high as the navel, and the legs were quite cold. The patient complained of acute pain in the back, and a depression was felt opposite the eleventh dorsal vertebra, but this subsequently disappeared, and he got rather better. Sloughs, however, shortly afterwards formed on the back of the foot and sacrum; all the left side of the body became œdematous; dyspnœa supervened, and death put an end to his sufferings.

Opposite the junction of the dorsal and lumbar regions of the spine there was a curvature, and the spinous processes of the last two dorsal vertebræ were broken, as was also the body of the twelfth. This latter fracture was transverse, and presented the first stage of consolidation, a true provisional callus. The corresponding portion of the cord was swollen and softened. The partial reunion of the fracture accounted for the patient's being able to move latterly without pain, in a way which he could not soon after the accident occurred.

The third case was that of a patient who threw himself from a third-story window. There was in this instance deformity, irregularity, and abnormal mobility near the lumbar region. The paralysis did not extend above the lower part of the thighs, but the bladder and rectum were included. As in the preceding cases, there was likewise marked amelioration of the symptoms in this: but it was only temporary, for subsequently the paralytic condition involved the whole of the lower limbs, an extensive slough formed on the sacrum, and the patient sank, preserving his intellectual faculties to the last. The spinal cord was found more voluminous than natural, especially at its lower part. Opposite the tenth dorsal vertebra was a cyst filled with pus, and formed in part by the medullary substance reduced to a fluid consistence: the body of the second (lumbar?) vertebra was fractured.

In the fourth case the membranes of the cord were found inflamed opposite the ninth, tenth, and eleventh dorsal vertebræ, where there was also a considerable clot of blood; but the medullary structure presented no alteration. The body of the tenth dorsal vertebra was fractured transversely; but during life this injury had not been detected, in consequence of there being no displacement. Concussion of the spinal cord was supposed to have given rise to the paralytic condition of the lower limbs and bladder: subsequently there was an amendment in the symptoms; sensibility was partially restored, and the bladder was evacuated voluntarily. But ultimately sloughs, prostration, and emaciation led to a fatal issue.

The fifth and sixth cases presented similar phenomena during the period that the patients survived, and, after death, analogous anatomical lesions.[1]

---

[1] [The editors state that, by the insertion of many of the cases contained in this article, they have fulfilled one of the last wishes of the author, who left the manuscripts of them for the purpose of their publication. Some licence has been exercised in curtailing a few of them in the translation.—Tr.]

CHAPTER XIX.

ON THE REDUCTION OF OLD DISLOCATIONS.

The question, after what lapse of time a dislocation ceases to be reducible, involves considerations of the greatest practical importance, which it will be my object in the present chapter to discuss and illustrate. There are several points associated with the anatomy of a dislocated joint which necessarily complicate the subject, by influencing more or less the permanence of the altered relation of the bones; such as the rigidity of the surrounding ligaments and muscles, which offers a considerable obstacle to reduction; and the cicatrization of the lacerated orbicular ligaments, which may be of such a nature as completely to prevent the return of a dislocated bone into its normal position.

It is only by the accumulation of facts that this question can be satisfactorily solved, or that we can hope to lay down any defined rules for the guidance of practitioners in similar cases. It was formerly a settled doctrine that no attempt should be made to reduce a dislocation after the first few days of its existence; and this opinion maintained its ascendancy for a long time. Even Benjamin Bell shared this dread of meddling with old dislocations, although he must have been acquainted with the success which had attended the practice of White and others in England: and the authority of Bell influenced Desault; although, if Bichat is to be trusted, experience led the French surgeon to adopt a bolder course of practice; and the success which he had in some cases of dislocation of fifteen or twenty days' standing, prompted him to attempt reduction as late as the thirty-fifth day. Bichat indeed asserts that, in the two years which preceded Desault's death, he had seen him reduce dislocations of two, three, and even four months' standing.

A memoir containing six cases, published[1] by M. Flaubert, surgeon-in-chief to the Hôtel-Dieu at Rouen, holds out but little encouragement to practitioners to attempt the reduction of old dislocations. In five of these cases the operation involved accidents of a very serious nature, such as the laceration of a large artery, as well as of nerves and muscles. The risk of these casualties, says M. Flaubert, is increased in proportion as the dislocation becomes of longer duration, or as it may happen to be accompanied by swelling or other signs of inflammation: for, he adds, "it is this inflammation, occurring prior to reduction, which appears to constitute the chief predisposing cause of these lacerations, by producing adhesion of the vessels and nerves to the surrounding parts. Moreover, this inflammation tends to soften the tissue of the muscles, as well as that of the arteries, and thus renders them less capable of resisting the force used during extension." The existence of adhesive inflammation was actually demonstrated in examining the bodies of two of the patients above alluded to: in the sixth case the reduction of an old dislocation of the femur was followed by death, which was the consequence of acute local inflammation and the severe constitutional disturbance to which it gave rise. Further, in four of these cases M. Flaubert is of opinion that much of the paralysis, which was attributed to the dislocation, was really due to the efforts to reduce it. It should be observed, however, that other surgeons have not met with the same misadventures as the Rouen surgeon; and it is difficult to discover any assignable cause for this peculiarity, unless it existed in an unusual concurrence of unfavorable circumstances in the subjects of the accidents.[2] On the contrary, the success which is said to have attended the attempt to reduce a dislocated hip of two years' date, must not induce surgeons to act upon this precedent. Indeed, I had occasion in 1829 to give my advice to a young man, who came to consult me about a dislocation of the humerus, which had existed for two years; and it was that he should allow nothing to tempt him to seek for its reduction.

---

[1] Répertoire d'Anatomie et de Chirurgie, tom. iii, p. 55.

[2] [Some observations here follow, which are extracted from a paper by one of the editors (M. Marx) in the 'Répertoire d'Anatomie,' &c., together with a table of thirty-five cases of dislocations, and the period at which each was reduced. Twenty-eight of these occurred in the practice of M. Dupuytren, and some of them will be detailed in the ensuing pages: it has therefore not been thought necessary to transcribe the extract; but the paper alluded to may be found in the 'Répert. d'Anat.,' tom. vii, p. 52; and is entitled "Jusqu'à quelle époque est-il possible d'opérer la Réduction des Luxations?"—Tr.]

CASE I. *Dislocation of the left thigh, reduced after the lapse of thirty-one days.*—Pierre Guilleminot, aged 21, a labourer, of spare habit, whilst wrestling with a companion, was thrown on his left side, the corresponding leg and thigh being carried forwards and strongly adducted, so as to cross the leg and thigh of the opposite side. The left femur was thus placed obliquely, between the body and the ground; the outer side of the lower part resting on the ground, and the upper part supporting the weight of the body: and by the leverage thus obtained the head of the bone was dislocated upwards and backwards. The patient was unable to rise or move the limb; and it was soon perceived that it was shorter than the other. He was taken home and a medical man sent for, who did not understand the nature of the injury, and consequently left him unrelieved. After thirty days had elapsed he came to the Hôtel-Dieu, in October, 1822.

On admission, the following symptoms presented themselves. The left thigh, which was shorter by three inches than the opposite, was slightly flexed, adducted, and very much inverted, as were also the knee and point of the foot. The great trochanter was higher and more prominent than that of the right side, and formed, together with the head of the femur, two distinct projections on the outer side of the buttock. The fold of the groin was both higher and deeper than that of the right side, and the resistance which the head and neck of the femur usually offer at this point was wanting. The limb could be neither fully extended, abducted, nor rotated outwards. The patient could manage to walk with the aid of crutches, and even to bear lightly on the extremity of his left foot when doing so.

When I saw this patient, I at once recognized the nature of the injury; and after carefully questioning him I promised to cure his deformity, provided he was not deceiving me as another patient had done, who, having a dislocated femur of nine years' standing, and being admitted into the Hôtel-Dieu for some trifling complaint, thought he might avail himself of the opportunity to get cured of his lameness: he accordingly did not reveal the fact that the dislocation had existed so long, until he had permitted his limb to be forcibly, though of course ineffectually, extended for three quarters of an hour.

On the night of Guilleminot's admission an ounce of syrup of poppies was administered, and an emollient poultice was placed over the left hip; and on the following day I proceeded to reduce the dislocation. The first attempt was fruitless; but on a second trial the head of the bone was restored to the acetabulum, the fact being announced by a sudden jerk, and a snap which was audible to the bystanders. The only apparent difference between the two limbs, after the reduction, was that the affected leg was a few lines longer than the other; a condition owing, no doubt, to swelling (or thickening) of the tissue investing the cotyloid cavity. The patient was carried to bed, and the two thighs were fastened together and placed, semiflexed, on a large pillow. For about three weeks he complained of pains in the sole of the foot, which were sometimes severe enough to awaken him: but these he had suffered from before the reduction, and they finally disappeared. On the twenty-fifth day he got up and walked with crutches; and in less than six weeks he left the hospital perfectly well.

Case II. *Dislocation of the humerus, reduced after thirty-eight days.*—Jacques-Louis Lefebvre, aged 39, of athletic make, was admitted into the Hôtel-Dieu in 1812, with a dislocation of the right humerus. The accident was characterized by the usual symptoms of lengthening of the arm, flattening of the deltoid, the presence of the head of the humerus at the lower part of the glenoid cavity, a tumour in the axilla, and inability to carry the arm forwards or over the head, or to bring the elbow to the side. The patient, being interrogated as to the mode in which the accident occurred, attributed it to some muscular exertion he had been making; not recollecting, or not choosing to recollect, that he had afterwards fallen, and that, in endeavouring to save himself he had extended his arm before him: he could not be brought to admit this, as he appeared to be afraid that, in assigning so trivial a cause for his injury, there would not be so much disposition shown to relieve him.

Notwithstanding the length of time that had elapsed since the accident, I did not despair of reducing the dislocation. The patient was seated in a chair, with the left side of the body resting against the balustrade of the theatre: a cloth, folded diagonally, was passed over a pad which filled the axilla, and firmly fixed by its two extremities; and for the purpose of making extension a towel was fastened round the wrist: I then directed the assistants, whilst I endeavoured to draw away the attention of the patient by asking him questions which he was obliged to answer. The reduction was accomplished in less than a minute; and although the usually accompanying snap was not distinctly audible, the natural length of the limb was restored, together with the solidity of the deltoid; and the head of the bone was no longer distinguishable in the axilla. It was thought right to take the precaution of keeping a pad in the armpit, and the elbow firmly bound to the side; but the patient left the hospital four days afterwards, with entire restoration of the various movements of the arm, which were executed without pain.

Case III. *Dislocation of the head of the humerus upwards and forwards, reduced on the forty-ninth day.*—Jeanne Charbonnet, aged 65, the mother of twenty-six children, short and decrepit, but nevertheless enjoying pretty good health, was admitted into the Hôtel-Dieu in 1819. She states that, in crossing a wash-house in the dark, she fell in such a way that the whole weight of the body was received on the right elbow: she returned to bed, and on the following morning was conveyed to the central depôt of hospitals, where a surgeon concluded that the pain and immobility of the arm were the consequence only of a severe contusion, and persuaded her that the application of emollient poultices for a few days to the shoulder was all that was necessary to effect a cure. The patient returned home perfectly satisfied, and scrupulously followed the directions which were given; and it was not until seven weeks had elapsed without the appearance of any amendment, that she sought for further advice at the Hôtel-Dieu. On examination, I detected a dislocation of the head of the humerus upwards and forwards, the characterizing symptoms being, separation of the elbow from the side, in which position it was fixed; deformity of the shoulder with flattening of the deltoid; prominence of the acromion, and the presence of the head of the humerus below the clavicle, at the upper, anterior, and outer part of the chest. I ordered that the patient should be bled, and have the shoulder poulticed; and on the following day she was brought into the theatre for the purpose of having the dislocation reduced.

The patient was seated on a chair; and a pad being then placed in the axilla, a folded sheet was passed across it, and the ends, carried obliquely one in front and the other behind the chest, were passed through a ring in the wall, and intrusted to two assistants, who were directed to make the necessary counter-extension. Another cloth was applied and fixed by means of a roller to the fore-arm (which had been previously wrapped in a piece of waxed linen); and its ends were placed in the hands of three assistants whose business it was to make extension. Matters being thus arranged, the first attempt at reduction was made, whilst I endeavoured to divert the attention of the patient by questioning her regarding her accident: both this and a succeeding trial were ineffectual; but in a third, in which those who were engaged in making extension acted more harmoniously, I was enabled, by pressing the head of the humerus downwards and outwards, to return it to the glenoid cavity. From this moment the affected shoulder assumed the same appearance as the opposite, although the head of the humerus could still be felt rather prominent in a direction inwards, and had a great tendency to slip out of its socket again, which circumstances taken conjointly induced me to suspect that some fibrous or ligamentous matter was interposed between the articulating surfaces: therefore, to obviate the risk of reluxation and ensure the cure, a bandage was applied so as to fix the lower part of the arm to the trunk and to bring it a little forward, at the same time that its upper part was kept separate from the body by the introduction of a conical pad into the axilla. On the twenty-second day after the reduction there remained no trace of deformity, and the patient was able to move the arm in various directions, as well as before the accident.

Case IV. *Dislocation of the left humerus, reduced on the* *sixty-second day.*—Servais, aged 32, a brigadier of Gendarmerie, of tall stature, dislocated his left humerus in May, 1829. The accident having been mistaken for a contusion, the shoulder had been leeched and poulticed; and it was not until two months had elapsed that this man came to consult me at Rouen, when I detected, by the presence of the usual signs, a dislocation downwards. I at first hesitated to recommend that the reduction should be attempted, because I very much questioned its practicability; and further because I dreaded that the force which it would be necessary to employ at this late period, might be attended with some such disastrous result as had recently occurred in the practice of M. Flaubert, surgeon-in-chief of the Hôtel-Dieu at Rouen. In one of these cases death almost immediately followed the efforts at reduction, and was caused by laceration of the artery: in another, the extension produced paralysis of the affected limb. However, the unflinching resolution of the patient and his importunity overcame my scruples, and after having prepared him by baths, low diet and occasional bleeding, I attempted the reduction on the sixty-second day after the accident; and after persevering for a time I succeeded. The after-treatment consisted in keeping the arm at perfect rest, in leeching the shoulder, and covering it with emollient fomentations. The movements of the arm were gradually extended, and the baths were continued until he returned home, which was at the end of two months; when he was able, without inconvenience, to attend to the duties of his calling.

CASE V. *Dislocation of the left femur, reduced on the seventy-eighth day: perfect cure.*—Joseph Diot, aged 23, a quarryman, when fourteen years of age, broke his right thigh and injured the leg of the same side in several places: the union of the fracture was attended by shortening to the extent of two inches. In December, 1817, he was thrown down and buried beneath a fall of earth; and some stones struck his head and face, by which he was seriously wounded and lost the sight of his left eye. Whilst under treatment it was discovered that he had also dislocated his left thigh; and five weeks after the accident an attempt was made to reduce it, but without success.

This patient was admitted into the Hôtel-Dieu towards the end of the following March (i. e. nearly three months after the injury was received), when the following appearances presented themselves. The left femur was dislocated upwards and outwards, but the shortening was very inappreciable on account of the previously diminished length of the opposite limb; the knee and point of the foot were very much inverted and approximated to the opposite limb, and rotation outwards was impracticable. The trochanter major was nearer to the anterior superior spine of the ilium, and more elevated than that of the opposite side; and another distinct prominence was perceptible behind this and above the acetabulum, which was the head of the femur occupying this abnormal site: the fold of the buttock was also deeper on the affected side, and the dislocated limb had a tendency to cross the other. A bath was prescribed, and on the succeeding day the reduction was conducted in the following manner.

The patient was placed on a horizontal bed, of sufficient height to prevent the assistants from being obliged to sacrifice power by stooping: the tibio-tarsal articulation was then wrapped in a well-waxed compress, which was in its turn covered by an ordinary one; and a folded cloth was next applied immediately above the heel, and crossed in front of the upper part of the instep, and the ends were placed, right and left of the foot, in the axis of the limb: the whole being fixed by a figure-of-eight bandage round the ankle. Another cloth, similarly folded, was placed in the groin on the sound side, which had been prepared by the previous application of an adhesive plaster: the extremities of this cloth were carried in front of the chest, passed through an iron ring in the wall at the bed's head, and intrusted to two assistants. A third cloth, likewise folded, was introduced through the left axilla, one end passing in front of the chest and the other behind the back, and likewise held by an assistant, who was directed thus to steady the body and prevent its swaying from side to side. A fourth cloth encircled the iliac bones, and its extremities were held by an assistant on the sound side, who was directed to fix the pelvis. Six assistants had hold of the cloth which encircled the ankle, for the purpose of making the requisite extension; whilst that which was placed in the groin was destined for the counter-extension.

The necessary preliminaries being thus arranged, I placed myself on the left of the patient, with my hands on the head of the dislocated bone, and directed that graduated extension should be made, at first in the direction which the affected limb had assumed, and subsequently outwards, when the head of the bone had begun to yield: during this time I pressed downwards the great trochanter, and drew the knee outwards. Some slight effect was thus produced, and a short respite was allowed to the patient, but without in the least relaxing the extension, which was soon resumed with increased energy, until at length a distinct snap announced the reduction of the dislocation. When the bandages were removed, and the limbs placed side by side, that which had been dislocated was found to be two inches longer than the other; and it was not until then that the fact respecting the previous fracture and shortening of the opposite thigh, was elicited. Notwithstanding the great force that was requisite for the reduction of a dislocation of such long standing, a trifling excoriation of the groin was the only ill consequence that attended it. Perfect repose was enjoined for some days, and then the patient began to walk with crutches, without being obliged, as before, to carry his limb forwards by describing a semicircle. In less than a month he left the hospital perfectly well.

CASE VI. *Dislocation of the humerus, reduced on the ninetieth day.*—A woman, aged 55, was admitted into the Hôtel-Dieu early in 1827, under the care of M. Sanson, with a dislocation of the humerus of ninety days' standing. M. Sanson succeeded in reducing it after two attempts, and no unfavorable occurrence supervened: the patient soon left the hospital well.

CASE VII. *Dislocation of the thigh upwards and outwards, mistaken for fracture of the neck of the femur; reduction on the ninety-ninth day.*—Madame R., aged 25, of slender make and nervous temperament, threw herself from a third-story window, and on the arrival of a neighbouring surgeon, who was sent for, he found her in the following condition. She was perfectly conscious, and complained of severe pain at the front of the chest, where it was ascertained that the sternum was fractured: the left thigh was much flexed on the pelvis, with the leg placed across the opposite thigh; and it was impossible to restore the affected limb to its natural position, without occasioning extreme pain in the hip. The knee and point of the foot were very much inverted; and the buttock exhibited a large ecchymosis, blood being extravasated in considerable quantity beneath the skin: lastly, on the dorsum of the left ilium, a hard globular tumour was felt, which, it was presumed, was the head of the femur; and the great trochanter was sensibly approximated to the crest of the ilium.

From the above signs, the surgeon who first saw the patient, together with two others who were subsequently called in, concluded that there was a dislocation of the femur which admitted of easy reduction: but no sooner was the patient put into bed, with every necessary precaution, than the shortening of the limb made itself again apparent, together with inversion of the point of the foot. They then abandoned their first impression, and set down the injury as a fracture of the cervix femoris, grounding this opinion on the facility of reduction, the immediate recurrence of the symptoms, and the relief experienced by the patient from the semiflexed position. They accordingly applied the apparatus usually employed at the Hôtel-Dieu; and when I saw the patient a few hours afterwards, I approved of the course which had been pursued.

During the three months that the apparatus was kept on, I did not visit the patient, but at the expiration of that time, I was again sent for. It appeared that there had been very severe, obstinate, and almost continual pain in the hip, groin, and knee of the left side, which were attributed to accidental attacks of inflammation, and the parts had even been leeched and poulticed with a view to its removal. The immediate cause of my being again summoned, was the condition of the limb when the apparatus was removed: to the great discomfiture and surprise of the medical attendants it was found to be at least four inches shorter than the opposite limb. I at once detected the mistake, and pointed out the real nature of the accident, which was a dislocation upwards and outwards: and after carefully examining the state of the affected parts, I recommended that reduction should be attempted, which was accordingly undertaken on the ninety-ninth day after the accident.

The requisite apparatus being applied, I directed the assistants to make extension first of all in the axis of the limb, that is to say, inwards and from left to right. The force, which was in the beginning carefully and gently employed, was gradually increased until great suffering was occasioned, which drew forth expressions of anguish from the patient. The head of the femur yielded, shifted its position, and had a manifest tendency to move downwards : a few minutes of repose were allowed, and then the efforts were renewed until they were at length crowned with success. Whilst the extension was being made, I kept my hands on the head of the bone, and directed it downwards and inwards as it gave way; and when it was sufficiently depressed, I desired that the extension should be made in a direction outwards and towards the left side. The reduction was accomplished by an audible snap and the restoration of the limb to its normal length and direction : the skin on the outer part of the affected side was a good deal lacerated and abraded. The patient suffered for several days from nervous symptoms, which ultimately yielded under the use of antispasmodics and baths; and a semi-anchylosis of the knee and foot, the result of the long confinement, also gave way under the employment of appropriate remedies.

CASE VIII. *Dislocation downwards of the humerus, with consecutive luxation into the subscapular fossa : ultimately reduced.*—In July, 1829, an old woman came to the Hôtel-Dieu, with a dislocation of the upper extremity of the humerus, which was produced by a fall on the hand, the arm being at the time separated from the body and extended forwards. The patient dated this accident at six weeks back, but she added that, during this interval, the arm had not always presented the appearance which it then did: she was able to put it in, as she expressed it, at will and by certain movements of the shoulder; but, when thus circumstanced, she experienced considerable difficulty in making use of the arm; for it was soon put out again if she attempted to do anything which involved extended movements of the limb, though she was always able to return it in the way described. Two or three days before her application at the hospital, the head of the bone had been displaced as before, but she had been unable this time to reduce it; and this was the reason of her coming for advice. I did not at the time put any confidence in the exactness of her history; nevertheless, as all the symptoms of dislocation downwards were evident, I thought it my duty to attempt the reduction in the ordinary way. Extension and counter-extension were accordingly employed, and the head of the humerus having shifted its position, at the same time that a peculiar sound was heard and the form of the shoulder changed, I thought that the reduction was accomplished: but the patient maintained that the arm was only restored to the condition in which it was a few days previously, when she was able, in a certain way, to move it in various directions.

I, therefore, again carefully examined the shoulder, and found that several of the symptoms of dislocation were still present, such as flattening of the deltoid, prominence of the acromion, &c.; and this led me to suspect that the patient might have told the truth. Extension and counter-extension were accordingly resumed, and without much effort I returned the head of the humerus into the glenoid cavity, the shoulder at once assuming a normal form, and all the symptoms of dislocation disappearing.

The circumstances of this case appear to admit of the following simple explanation. The head of the humerus, after having escaped from the articular cavity by distending and bursting the capsule, occupied a position on the inner side of the axillary border of the scapula, and a little within the subscapular fossa. Whilst in this situation the patient had contrived, by certain manœuvres, to place the head of the humerus on the scapula, immediately below the glenoid cavity, where a better fulcrum was obtained; and she was then enabled to use the arm, albeit somewhat awkwardly, as if it had not been dislocated: though, as the history showed, any extended movement threw it back again into its former position, and then the more marked signs of dislocation presented themselves, such as were apparent when she came to the hospital.

The preceding cases will suffice to prove that the reduction of old dislocations may be attempted and accomplished without risking, in general, any serious contingencies. It may be well here to introduce a few observations on some of the consequences of dislocation, which are more or less frequently met with. Œdematous swelling rarely supervenes except in cases of axillary dislocation, and is dependent on pressure of the head of the humerus on the lymphatics and veins of the arm. This symptom generally disappears shortly after the reduction of the dislocated bone, or, if it persist, the employment of a roller is all that is necessary. If inflammation of the joint come on, it must be combated by active treatment proportioned to the intensity of the attack, such as local and general blood-letting, baths, and emollient fomentations. Partial or general paralysis of the muscles of the arm, also frequently observed, is the consequence of the brachial plexus, and particularly of the circumflex nerve, being stretched and contused by the head of the humerus in its escapes from the glenoid cavity. When the cause of this condition is limited to simple pressure, it is generally curable by the early use of antiphlogistic measures, and afterwards of counter-irritants, such as blisters, or even a moxa made above the clavicle, over the origin of the brachial plexus. But when, on the contray, the nerves are disorganized there is no hope of recovery: the patients continue all their lives affected with paralysis of the deltoid (if the circumflex nerve alone be injured), or of the entire muscles of the upper arm and fore-arm, (when the lesion involves the entire plexus.) It is, however, scarcely necessary to add that, in all cases of paralysis attending dislocation, the remedial measures above mentioned should be tried, as it is impossible to establish *à priori* whether the symptoms arise from simple compression or organic lesion. Laceration of the axillary artery is an extremely rare occurrence, and is more likely to result from the attempts at reduction, than from the dislocation itself.

For the purpose of aiding the reduction of old dislocations I am in the habit of prescribing warm baths, and of directing that the affected joint should be enveloped in an emollient poultice, rendered narcotic by the addition of laudanum, extract of aconite, henbane, or belladonna: and if the patient is young, I do not hesitate to bleed more or less freely. The following are the steps of the operation itself, as conducted in cases of dislocated humerus. The patient is stripped to the waist, and seated in a chair, which is placed near a part of the wall in the theatre where a strong iron ring is firmly fixed: the lower part of the forearm a little above the wrist is covered by a waxed compress, for the purpose of preventing the towel, the centre of which is crossed over it and attached by a roller, from slipping. A pad of charpie, wrapped in a piece of linen, wedge-shaped and about the size of a young child's head, is lodged in the axilla: over this pad the centre of a piece of new cloth, which should be strong and inextensible, is placed; and, after being crossed, both ends of it are passed through the iron ring in the wall. Assistants, to the number of two or three, grasp the extremities of this cloth, whilst others take each end of the towel: and in this way the patient is much more firmly fixed, and extension is more effectually made, than where counter-extension is merely trusted to assistants, without the additional power derived from the use of the iron ring. The assistants proceed to make extension, whilst the surgeon, placing himself on the outer side of the limb, directs them. If the case be an axillary dislocation, the extension should be first made in the direction of the displacement, and then the arm should be drawn downwards and forwards, the surgeon at the same time directing the head of the humerus upwards and outwards, whilst he rests the outer side of the elbow against his own chest. If the dislocation be inwards, the extension must be directed outwards and backwards; and then, when the head of the bone is disengaged, the operator should press it outwards. But in dislocation into the fossa infra-spinata, the extension must be first made from behind forwards; and when the head of the bone is dislodged, the operator should press it in the same direction, i. e., forwards, and then the arm must be extended more directly outwards.

When peculiar difficulties are met with in the reduction of old dislocations, various mechanical means have been advocated for the purpose of increasing power; but I place much more reliance on a moral agent I am in the habit of employing with excellent effect, viz., the distraction of the patient's attention, by which the active resistance of the muscles is in a great measure suspended. The snap which the head of the bone makes on re-entering its cavity, together with the restored form and motions of the joint, are indications that the reduction is accomplished: after which the arm is to be fixed to the side by a body bandage, and the elbow and fore-arm are to be supported in a sling. Entire repose of the limb should then be enjoined for three weeks or a month, in order that time may be given for the swelling to subside, and especially for the rent capsule to heal. Without this precaution the dislocation may be reproduced; of which accident M. Sanson witnessed a striking example at the Hôtel-Dieu, in a man who chose to use the limb too soon, and was obliged to come several times a week to have reduced an axillary dislocation of the humerus, which was reproduced every time that he abducted the arm rather widely. In the space of four years the same Professor was called three times to an accident of a similar nature, and due to the same cause: it occurred in the person of an athletic young man.

The accidents which have been enumerated as occasionally complicating dislocations, may also be the consequence of the reduction, especially in cases of long standing: but their occurrence is more rare than is generally supposed; at least I have found them so. Emphysema of the chest has been observed by Desault as well as by M. Flaubert, after attempts to reduce a dislocation: the proper practice in such cases is to employ resolvents externally, and to apply graduated pressure, by means of a bandage, to the swelling.

PART II.

ON THE DISEASES OF BONES.

CHAPTER I.

ON LATERAL DEPRESSION OF THE WALLS OF THE CHEST.

In a previous chapter I spoke of congenital displacement of the ossa femoris; and I am now about to describe a deformity of the chest, which is even more common and more important than the dislocations alluded to: indeed, scarcely a month passes without my meeting with several examples of this deformity; and as it affects the parietes of a cavity which incloses organs of vital importance to the animal economy, it naturally follows that the due performance of the functions of those organs must be mechanically interfered with by the defect in question, and the consequences are proportionately serious. The deformity to which I allude consists in a depression of the sides of the chest, varying in degree, and accompanied by a corresponding prominence of the sternum and abdomen anteriorly, and of the vertebral column posteriorly.

Some authors have spoken of this deformity in treating of the diseases of children, and others in connexion with rickets: amongst these may be mentioned Van-Swieten, J. L. Petit, Levacher, &c.; but a simple perusal of their works is sufficient to convince the reader that they convey a very imperfect idea of the causes and consequences of this defect, or of the proper remedial means to be employed for its relief.

This abnormal disposition of the chest is especially observable in the children of individuals of lymphatic, scrofulous, or rickety diathesis, living in low, damp, and cold localities: insufficient clothing, and food of a poor and unnutritious quality also operate in favouring the production of the deformity in question. Children who are the subjects of this vicious conformation are pigeon-breasted, and have the vertebral column correspondingly ridged and prominent; the ribs are not only flattened, but forced inwards towards the interior of the chest, and appear as if they had been actually so compressed, whilst they were still soft and flexible. This deformity is so exaggerated in some instances, that the two sides of the chest may actually be clasped between the fingers and thumb of the same hand; and the ordinary relations and natural dimensions of the cavity are then so far changed, that the lateral diameter is diminished by a quarter, a third, or even half of its normal extent, whilst the antero-posterior and vertical diameters are proportionally augmented; thus exemplifying the compensating power exercised in such and similar cases by nature. If, however, this compensation be not complete, so as to permit the healthy performance of their functions by the heart and lungs, the deformity in question produces a constant and great oppression, habitual shortness in breathing and interference with the voice, together with painful anxiety and distress. The newborn infant has great difficulty in drawing the breast, and after retaining the nipple for some time in the mouth, it is threatened with suffocation, and obliged to quit the breast with loud cries. At a later period speech is interrupted, and words are spoken as it were by jerks. All these symptoms are aggravated by exertion, such as going up and down stairs, and in speaking with animation and action; in fact the condition of these patients is very much such as is perceived in individuals who are affected with diseased heart. The deranged functions of this organ, the irregularities of the pulse, which is sometimes abnormally slow, at others accelerated, might lead one to suppose that the heart is actually diseased, if the suspicion were not corrected by a careful examination into the real origin of these symptoms, which may be traced to the irregularity affecting the respiratory movements. During sleep the patient breathes loudly and open-mouthed, for the respiration is embarrassed by the defective conformation of the chest and by enlargement of the tonsils: and the sufferer is often agitated with painful dreams associated with the distress experienced, and starts up shrieking and alarmed.

The symptoms which have just been described, and especially the embarrassment of the circulation and respiration, may exist in sufficient force to arrest the development of the vital functions, and thus cause death shortly after birth. When death is not the immediate consequence of this obstruction, it may result at a later period from the interference with the act of suckling, or even from the imperfect assimilation of the food and defective nutrition of the body: or if the defect be so far modified as not to involve a fatal issue either primarily or consecutively, the affected infants continue thin and feeble, and so incapable of any exertion that the greater part of their faculties remain dormant.

One remarkable point about these cases of deformity is, that they are almost invariably accompanied by considerable enlargement of the tonsils;—an association which it is difficult to account for, but which renders the respiratory efforts still more distressing. This enlargement was so great in some instances as to oblige me to excise these glands, by which a certain amount of relief was always obtained. Another, and not less frequent concomitant of the defect in question is pulmonary catarrh; and a very serious complication it is; for we then have coexisting in the same case three several causes of obstruction to free respiration. But of all diseases to which children in this condition are liable, no one is more frightful or dangerous than hooping-cough; and I have never witnessed a more painful and distressing spectacle than that presented by a wretched infant thus affected: each fit of coughing seemed to threaten immediate dissolution; and, in fact, ultimately the little patient I allude to died during one of these paroxysms. It is therefore evident that such cases call for prompt and energetic treatment, if we desire to prolong life.

I have just remarked that enlargement of the tonsils frequently accompanies depression of the walls of the chest, and that I have been frequently called on to excise them in infants at the breast. Is it then preferable to attack this cause of suffering at once, or to wait? It has fallen to my lot to have repeated proof of the difficulty attending this operation, at a period of life when reason has not yet learned to control the impulses of instinct, and I have been driven to the ultimatum of excision only by the imminent danger which threatens life: for I have seen infants affected with the complication alluded to fall into an alarming state of convulsions and suffocation approaching to asphyxia, after vain and painful efforts to breathe, which are distressing to behold: the alternative therefore is to see such children die in frightful suffering, or to do that which is requisite for their relief. The best instrument that I am acquainted with for extirpating the tonsils is one invented by my pupil, Dr. F. Lemaitre, with the assistance of which the operation may be performed with safety and success.

In examining the bodies of many infants thus affected, who have died from the effects of this vicious conformation or in consequence of other accidental causes, M. Breschet has remarked an arrest in the development of the skeleton, the bones of the head remaining separated at a period when, normally, they should have been united; the epiphyses being still isolated, the extremities of the long bones enlarged, and their shafts contorted and soft, in which latter respect they resemble the texture of bones macerated for some time in weak nitric acid; and they were, in some instances, even more easily cut than broken. The venous system generally was well developed, and the cellular tissue of the bones was of a deep red; as if from venous vascularity. Dentition was late, and both first and second teeth were altered in character, their crowns being eroded, partly destroyed, and furrowed on their anterior surface. The lungs were compressed in correspondence with the vicious form of the thorax; and at their posterior part they were grooved by the ribs, and raised into ridges opposite the intercostal spaces.

It appears evident, then, that these deformities and their accompanying complications deserve careful attention, and require decided treatment at the hands of the medical practitioner; and the first point to be attended to applies equally to all cases of deformity of the osseous system, where such deviation from a healthy condition is referable to the softening of a scrofulous or rickety diathesis, viz., an invigorating diet and the exhibition of bitter drinks: at the same time great caution should be observed in carrying out this plan of treatment, as the existing mischief may be greatly enhanced by over-stimulating the system. The adjunct of local remedies will be found serviceable; and of all those that I have employed, I know not of any more efficacious than appropriate exercises for strengthening the muscles which connect the arms and shoulders with the chest; combined with frequent pressure, in a direction from before backwards, on the sternum. With the above view I direct my patients to employ both arms in raising a weight in a machine constructed for the purpose, for several hours daily. This apparatus is so arranged that a weight (which must be proportioned to the power of the individual for whom it is prescribed) is fixed to one end of a cord which passes over two pulleys, the other extremity of the cord having a cross-bar attached to it by which the machine may be worked. Further, the length of the cord should be such as to oblige the individual using the machine to rise on tiptoe when the cross-bar is seized, and to bend towards the ground before the weight is raised to its full height: in this way the objects of the exercise are best fulfilled, as both the flexor and extensor muscles of the arms, as well as the muscles of the chest, neck, and back are thoroughly brought into play.

In addition to the above measures, I am in the habit of directing that pressure should be made on the chest so as to diminish the antero-posterior diameter of its cavity: and for this purpose I do not approve of the usual method adopted, in which the object is attained by a machine that is constantly worn for the purpose, and which is open to the objections common to all similar instruments acting by a spring or otherwise. I prefer the following plan, as free from the inconveniences alluded to, and offering the best prospect of success: it consists in the operator's placing himself by the side of the patient, and supporting the back with one hand (or with the knee or by fixing it against a wall), whilst the other is placed on the most prominent part of the sternum; the latter is then pressed or pushed backwards so as to diminish the antero-posterior diameter of the chest, which is immediately afterwards allowed to recover itself. These alternating movements should be made to correspond with the acts of inspiration and expiration; and after some little practice, this proceeding will be readily accomplished by the common consent of both parties concerned. The exercise is accompanied by a sound resembling the rushing of the air into and out of a pair of bellows.

I have very often observed, with attentive curiosity, the immediate effects of this exercise: in the first place, the keel-shaped sternum is flattened, and the ribs are more or less curved outwards; the chest assumes for the moment a more normal form, and the act of respiration is altogether much stronger and more complete than it usually is: when the pressure is removed, the return of the parts to their ordinary condition is accompanied by a full inspiration. It is scarcely necessary to remark that the oftener this exercise can be conveniently repeated the better, and it should be continued for several minutes consecutively: but it is too important to intrust to an indifferent person; the tender care of a mother alone promises the perseverance which is necessary for success, and with its aid there is scarcely a deformity of the kind I have been describing which may not be remedied, as many striking examples have proved to me. The following case has been selected at hazard from amongst a great many, and will serve to illustrate the advantages of pursuing the course of treatment above recommended.

Case I. *Scrofulous constitution; depression of the chest; cure.*—A female infant, the issue of a rickety mother and scrofulous father, was born with great embarrassment of breathing, and still greater difficulty in taking the nipple, and especially in keeping it in the mouth. Its cries, and the eagerness manifested for food, together with the inability to satisfy this craving, were the cause of my being sent for: and I at once observed that the movements of respiration, as well as those of the heart, were constantly oppressed and frequent, and often troubled. The child was continually crying and agitated, and ravenous for food: if put to the breast it seized the nipple with avidity, but almost as soon as the milk began to flow abundantly it quitted the breast, crying piteously, and painfully convulsed: this scene was repeated as often as it attempted to suck. In addition to the above symptoms the sides of the chest were very much depressed, the sternum and belly being proportionally prominent, whilst the vertebral column projected backwards. The nostrils were free and the tongue naturally formed: and the nurse's nipples were well developed, and yielded milk readily. All the symptoms which have been detailed were, therefore, referable to the deformity of the chest.

As this distressing state could not be instantly remedied, it was necessary to support the infant in the interval; and this was effected by preventing the breast from falling against the nostrils so as to obstruct respiration through them, and by carefully cleansing these passages: the nipple was also alternately introduced into and removed from the mouth, so as to allow breathing-time; and the child was gradually taught to take food from a spoon. By attention to these points the child attained to three years of age, and even thrived; but the deformity continued, and with it the difficulty of breathing, the oppression and disorder of the circulation, and the consequent effects upon the system generally. At this period the sound which issued from the throat in breathing attracted attention to the tonsils, which were found to be so much enlarged as to reduce the isthmus of the fauces to half its natural capacity. Repeated attempts were made to employ a tonic plan of treatment, but which it was necessary, for reasons already stated, ultimately to abandon. It was then I recommended that the course should be undertaken which I have above described, the child being at the time between three and four years old. This was pursued with such zeal by the parents and friends, that pressure was made on the chest in the way I directed, at least a hundred times a-day (the child being passed from the hands of one to another), and with the most happy results. In the course of six months the deformity was much diminished, and the respiration was more regular and easy: the tonsils also decreased in size.

Six or seven years now passed, and the child waxed strong and healthy, but as the deformity and attendant symptoms were not entirely corrected, I recommended that the exercise with the pulleys should be commenced: this was pursued with equal diligence for two years, and was finally crowned with complete success.

Case II.—Michel Pottier, aged 6 years, began to complain of difficulty in breathing three months before I saw him. As this embarrassment increased, the parents were naturally led to examine the chest, and were surprised to find that it was unlike that of other infants. They came to consult me in 1821, when the following condition presented itself. The form of the upper part of the thorax was pretty good, but, below, the sternum projected forwards, and carried with it the lower ribs, giving to the laterally flattened chest a form which resembled the breast of a turkey, or the keel and sides of a ship: by pressing, however, with one hand on the sternum and the other on the back, the normal form of the chest could be restored. The advice given in this case also was, to employ pressure in the above direction, with a view of curing this defective development.

Case III.—Cécile Petit, 2 years old, was an eight-months' child, and put out to nurse, where she was subjected to great suffering. The mother brought her to the Hôtel-Dieu in the following condition. The head was large but well formed; the face was shrunk and had a painful and prematurely old expression; the eyes were deep-set and fixed, with dilated pupils and arid blueish conjunctivæ; and the cheek-bones were prominent. The respiration was short, loud, and rather hurried; the chest presenting a larger transverse than antero-posterior diameter, and being wider below than above: the sternum was prominent, and the ribs were flattened and forced inwards at the sides of the chest, whilst the vertebral column was raised into a sharp ridge. The abdomen was five times as capacious as the thorax; and the limbs were so wasted that the joints were three times the size of the fleshy parts. Further, the tonsils were enlarged, and the child slept with its mouth open, breathing loudly.

Case IV.—Augustin Secourieux, 13 months old, was a seven-months' child, and feeble at birth: he was put out to nurse, but, not thriving, he was brought to me for an opinion. The head was large and long: chest flattened laterally, especially at its upper part; inferiorly it was wider, and appeared as if the inner surface were turned outwards: the sternum was prominent, and the fifth, sixth, and seventh ribs of the right side ·re depressed towards their anterior extremities, so as to present a shallow cup-like cavity. The left clavicle projected very much forwards, its sternal end being extremely enlarged; whereas the opposite bone presented the enlargement without the prominence: the elbow and wrist-joints were also swollen. Similar deformity existed in the lower extremities; and the child's general health was bad, from the defective condition of the assimilative and respiratory apparatus.[1]

---

[1] [It is not stated whether any treatment was employed in the last two cases.—Tr.]

CHAPTER II.

ON CARIES OF THE VERTEBRAL COLUMN: FISTULOUS COMMUNICATIONS AND SYMPTOMATIC ABSCESSES. GENERAL CONSIDERATIONS ON FISTULAS, AND ON THE FORMATION OF A NEW TISSUE IN THEIR COURSE.

ONE of the most curious points in the pathology of the bones unquestionably is the history of caries. What is the origin of this singular alteration? To what class of lesions is it to be referred? Why is its progress, in the great majority of cases, so slow? Wherefore should it especially select the vertebral column for its attacks; and why should its existence in this part remain hidden until revealed by the presence of pus at a considerable distance from the seat of disease? The simple enunciation of these interrogatories points out the interest which attaches to the subject, and induces a belief, that the only satisfactory solution of the difficulties which surround it is to be sought for in the illustration afforded by cases of the disease.

CASE I. *Caries of the vertebral column; abscess, and death, after apparent convalescence.*—A female was admitted into the Hôtel-Dieu with an abscess on the inner and upper part of the thigh: she was also the subject of curvature of the spine, the convexity of which was directed backwards; but it was not sufficiently angular to compress the cord and thereby produce paralysis of the lower extremities. The femoral tumour broke spontaneously, and a large quantity of pus escaped: but there existed another, though smaller swelling on the opposite side, which had evidently a similar origin; indeed, it was manifest that both abscesses were associated with the seat of caries in the spine. This patient had been treated by preparations of iodine for three months, and it was supposed she was cured; whereas the caries had not been arrested in its course. I ordered that a moxa should be made on either side of the seat of curvature, and marked benefit followed this treatment: but she was suddenly seized with symptoms of pleuro-pneumony, referable either to change of temperature, or possibly to absorption of matter, which carried her off in the course of a few days.

Autopsy, thirty-six hours after death.—The body was emaciated, and the spinous processes of the eleventh and twelfth dorsal vertebræ were very prominent. There was considerable effusion of sero-purulent fluid into the right side of the chest, with some adhesions of the corresponding surfaces of the pleura, but no congestion of the lung. There was but little deviation from a healthy state in the abdominal viscera. The body of the eleventh dorsal vertebra was entirely destroyed by caries, but the vertebral canal was not at all encroached on, and the cord preserved its natural appearance. The bodies of the tenth and twelfth dorsal vertebræ were partially denuded, and the seat of superficial caries: a vertical section from before backwards exhibited a softened state of the interior, which the scalpel penetrated with facility. In front of the eleventh dorsal vertebra the cellular tissue and periosteum were condensed and hypertrophied, forming a thickened and tough pouch, the inner surface of which was bathed in pus and covered by a false membrane: this bag was still connected to the diseased vertebræ by some rather tough bands. From its interior a sinus extended on either side along the sheath of the psoas muscles, the fleshy portion of which was atrophied and pale. Each of these sinuses was filled with pus, and the right one was large enough to admit several fingers: its purulent contents were thin and unhealthy; and it was lined by a thick false membrane, beneath which was a delicate, rose-coloured membrane, similar in appearance to the mucous tissue. The fistulous canal in question was expanded above and below the crural arch, especially in the latter position, where it formed a very large pouch at the upper part of the thigh; and it was with this that the external opening communicated. The sinus on the left side extended likewise from the sac in front of the vertebræ, and took a similar course, and presented a corresponding opening; but with this difference, that there was no dilatation below Poupart's ligament as on the opposite side. Its internal surface was gray, and its lining of mucous membrane appeared to be of recent formation: beneath this membrane was another of a whitish hue, and resisting, fibrous texture. This tissue constituted almost the entire canal, to the destruction of the areolar tissue, through which the pus was first poured. This sinus had already contracted, in some parts, to a mere capillary canal; and everything seemed to indicate that a natural cure was in progress.

Hunter was the first to point out the formation of these mucous canals; and wherever they are met with, whether extending from a carious bone, or connecting the urethra and perineum, or around the anus, or communicating with Steno's duct, they are in all essentials identical in their nature and organization. When accidental and abnormal, they frequently supersede the natural passages, which are destroyed, perforated, or contracted. These newly-formed canals will traverse all the tissues with which they may chance to come in contact: thus, fibrous, nervous, osseous, mucous textures may be all implicated in their composition, as was illustrated in the case which has just been narrated.

Case II. *Extensive caries of the vertebræ, attended by paralysis, but without symptomatic abscess.*—The following case occurred in M. Sanson's practice. A man, aged 30, who had belonged to a military band, had been suffering from rheumatic pains. He was tossed by a bull, and his fall occasioned pains in the back, succeeded by curvature affecting the bodies of five or six of the dorsal vertebræ. Paralysis of the lower extremities, and of the bladder and rectum supervened; but there was no appearance of abscess. The absence of this symptom is to be explained by assuming that the deformity in question was referable to simple softening of the bones,[1] and that the mischief did not proceed further: the bodies of the vertebræ thus became flattened as they expanded, but without erosion, caries, or suppuration. The patient suffered violent spasmodic pains in the lower extremities, and there seemed every probability that he would sink sooner or later from the effects of the injury and its consequences.

---

[1] [Therefore improperly denominated "caries."—Tr.]

When caries affects a vertebra, the suppuration, which is at first confined to the affected bone, gradually extends itself; and usually burrows, by its own gravity, along the course of the vessels, until it accumulates behind them below the crural arch, so that the femoral artery may be felt pulsating in front of the tumour.

Many years since I was sent for to one of the medical wards to open an abscess in the thigh, and was surprised to see distinct pulsation at its anterior part. I at first supposed it must be an aneurism, until I perceived that the throbbing was confined to a narrow line, and thus became convinced that the femoral artery was only lifted up, and could thus be easily avoided. If this had not been observed, the trunk of the artery or one of its branches might have been wounded. When these tumours have reached the crural arch, they extend sometimes in one direction, sometimes in another: they may spread along the ribs to the sides of the abdomen, or into the pelvis, in following the course of the external iliac artery: or, again, the matter may extend itself along the sciatic nerve, and point at the upper and back part of the thigh; or it may even accompany this nerve to the lower part of the thigh before it is apparent: in short, there is scarcely any direction which these abscesses may not follow.

Case III. *Caries of the vertebral column; abscess, and death.*—George Pincher, aged 22, was admitted into the Hôtel-Dieu in 1824. He was a journeyman tailor, and in an extreme state of emaciation. Five months before a tumour had presented itself at the upper and anterior part of the left ilium, which had been opened and yielded a large quantity of matter. A second swelling made its appearance, a few days after the first had been evacuated, at the right (iliac) fossa: this broke spontaneously. He was much exhausted by diarrhœa, and suffered from thirst, want of appetite, and evening exacerbations of fever. This patient dated the commencement of his illness a twelvemonth back, when he first experienced pain: and it is reasonable to suppose that the confined position which his occupation entailed, together with the habit of masturbation which he had acquired, contributed to develope the disease, which proved fatal in less than six weeks from the time of his admission.

A *post-mortem* examination showed that the wound at the crest of the left ilium was only the inferior extremity of a long canal, which extended in the iliac fossa, along the psoas muscle, to the lower part of the vertebral column. Its parietes were formed, internally by the psoas itself; anteriorly by a bed of areolar tissue, dense and almost fibrous, and covered by peritoneum; externally by the kidney, ureter, veins, arteries, and nerves. Its interior presented the appearance of very red mucous membrane, of which it was impossible to raise any continuous portion. The bone was not denuded at any point; but the canal was entirely circumscribed throughout its whole extent: and although its upper extremity approached the vertebræ, their texture was not diseased. Internal to the same psoas muscle, between it and the spine, was another abscess without external opening or communication with the first, and which, having destroyed some parts of the periosteum and fibrous tissue, abutted upon the lumbar vertebræ. At these points the compact tissue of the bones was broken down, and the cancellated structure was more red than natural. In the median line and beneath the common anterior ligament of the spine, a third abscess existed, which opened into the last, and extended in front of the sacrum even to the coccyx: these bones were in the same condition as the vertebræ. But the greatest amount of mischief was found in the fibro-cartilage between the third and fourth lumbar vertebræ; three fourths of it was destroyed, and the two bones which it connected moved loosely on each other, being covered at their opposed surfaces by a grayish false membrane, and bathed in pus. In front, the matter had taken the course of the pyramidal muscle, and made its exit from the pelvis by the great sciatic notch, whence it descended an inch further in the nates. Posteriorly the pus had burrowed along the dura mater of the sacral canal, and extended to the lower third of this bone. Above the centre on the right side, and between the skin and gluteus maximus muscle, was another collection of matter, the cavity containing it being similarly lined, but separated from the other sacs, and unconnected with any lesion of bone. The upper part of the left lung presented just a trace of tubercular disease.

CASE IV. *Caries of the ribs, lumbar vertebræ, and sacrum.*—

Hermann, aged 27, a boot-maker, was admitted into the Hôtel-Dieu in 1824. He was tall, with a large face, and the extremities of the bones big, whilst the muscular system was ill developed, and the skin fine, white, and smooth. He had never been ill before, and said he was not addicted to masturbation. Eighteen months before his admission, he had been seized with undefined pains in the loins and along the spine, which ultimately fixed themselves in the upper lumbar region: but they were not of sufficient severity to impede his walking or to produce any other marked effect. Eight months since, however, a swelling made its appearance in the right groin, which slowly extended itself to the middle of the thigh, where it formed a considerable prominence. The loins had been blistered, but without any benefit.

As some very decided measure was necessary in this advanced stage of the disease, I directed the application of the actual cautery. This was freely employed, and for the first few days there was sensible benefit from its effects: but our hopes were soon dissipated by the bursting of the abscess, which was succeeded by fever and vomiting. The pus which escaped was of a scrofulous character, but shreds of false membrane were also discharged from the wound, indicating that inflammatory action had been recently set up in the sac. After alternating between better and worse for a time, the patient ultimately sank under diarrhœa and the discharge; and died, little more than two months after his admission into the hospital.

Autopsy.—The two superficial openings in the thigh communicated with a very large sac, which was situated beneath the fascia, between it and the superficial muscles in the middle of the anterior femoral region. The vessels traversed the cavity of this abscess, which indeed extended as low as the opening in the adductor magnus: and although the muscles were in a state of perfect preservation, they were brown, covered with adventitious membrane, and inflamed on their surface. At the crural arch the sac was constricted, but extended upward into the iliac fossa, between the iliacus muscle and areolar tissue, and occupied also the interior of the psoas even to its upper extremity. Throughout this part of the abscess, its parietes were organized like the mucous membranes. Along the spine, the anterior lumbar[1] nerves passed through the s at its inner and fore part; but the latter was closed, and w unassociated with the diseased vertebræ at any point: the p which it contained was fetid, dark coloured, and mixed wi portions of false membrane. On the interior of the upp portion of the sac in question, the fibrous structures prop to the vertebral column were thickened and separated from th bone: when incised, pus escaped from beneath them, which wa pale, thick, and like softened tubercular matter: it was throughout in direct contact with the osseous structure. The second third, fourth and fifth lumbar vertebræ, as well as the uppe part of the sacrum, were denuded and rough; and such o their texture as remained presented a normal consistence an appearance. At the points where the bone was carious, ther were irregular excavations in the bodies of the vertebræ, i which the pus was lodged. The anterior surface of the fift rib, near its vertebral extremity, was likewise carious; it periosteum and the neighbouring areolar tissue being thickened and bathed in pus.

CASE V. *Caries of the vertebral column; abscess, and death* —Deffacé, aged 23, was admitted for the second time into th Hôtel-Dieu in 1824. He had been long the subject of phthisis and latterly had been afflicted with inflammation, succeeded b an abscess at the lower part of the dorsal region of the spine this disease had left fistulous openings, for which he had bee previously under treatment. Fetid pus now escaped i abundance from the fistulous openings on the left of the spine and when he coughed or took a deep inspiration it was thrown out in a jet to the distance of some inches, from which circumstances it was inferred that the lungs were the source of th suppuration. The skin in the neighbourhood was thinned, an separated for a space equal to the palm of the hand. He die three weeks after admission.

Autopsy.—At the lower dorsal region there were three circular spots of ulceration, all on the left side, but more or les removed from the ridge of spinous processes. There was a considerable collection of fetid pus beneath the skin, but only two of the openings in question communicated with the soft parts beneath. The larger of these was the outlet of a wide sinus, with a mucous surface; and this extended downwards for three inches, into the substance of the extensor muscles of the spine, where it terminated in a cul-de-sac, which had no communication with the bone or other deep parts. The upper orifice was the outlet of a narrower and more tortuous sinus, which extended along the posterior part of the abdominal parietes, penetrated the diaphragm, and entered the chest between the ninth and tenth ribs. A large abscess here occupied half of the left pleura, being bounded above by adhesions of the lung to the costal pleura, below by the diaphragm, internally by the lung itself, and externally by the walls of the chest: its interior was lined by several layers of adventitious membrane, and contained a quantity of fetid, gray pus; the sac itself being evidently formed by the pleura, converted by long disease into a thick, firm, cartilaginous texture. There was, however, no communication whatever between this cavity and the bones; but the ligaments of the spine were thickened at this part, and separated from their natural osseous connexions by intervening fluid. The pus which issued on incising these ligaments, was yellow and inodorous, and in contact with the diseased dorsal vertebræ, the left half of the last four of which was destroyed: their texture was dark and irregular, and the fibro-cartilage between the eleventh and twelfth had almost disappeared. Lastly, the articulations of the eight, ninth, tenth, and eleventh ribs on the right side were inflamed, and their cartilages broken down and floating in pus. There was likewise ulceration of the intestine, and there were cavities in the lung.

---

[1] ["Cervicales" in the original, but evidently a misprint.—TR.]

CASE VI. *Caries of the vertebral column; phthisis, and death.*—Marie Charlotte, aged 55, an embroideress, was admitted into the Hôtel-Dieu in 1824. Her left elbow had been affected for about ten years; and for the last six months there had been a fetid discharge from a fistulous opening. The dorsum of the right foot was similarly affected; and she had also symptoms of advanced phthisis. She survived her admission only twelve days, and an opportunity was thus afforded of examining her body.

The lungs were tubercular, and presented numerous cavities. The articular surfaces of the radius and ulna were denuded, dark and rough, and bathed in fetid pus: the spine was abruptly curved at three several points. Moreover, the cancellated texture of the bodies of the vertebræ was red throughout, easily sawn through, and in some places black and dry. On the left of the spine, and on a level with the first lumbar vertebra, was a sac formed by the thickened common anterior ligament and other neighbouring fibrous textures. When this was opened, about an ounce and a half of thick, yellow, homogeneous and fetid pus was discovered between the ligaments and subjacent bone: the latter was denuded and rough.

The preceding cases are pregnant with important considerations. Invariably the soft parts, both filamentous and fibrous, which strengthen the vertebral column, were thickened, dense, and presenting evidence of chronic inflammation: the periosteum was stripped off to a variable extent; and pus was found deposited between the denuded bone and the tissues which naturally encase it. Further, there existed in almost every instance extensive, though more superficial, suppuration along the muscles and vessels. Where symptomatic abscesses existed, all the above textures combined to form them; and when they were first opened, whether spontaneously or artificially, the pus was without fetor, and not sanious, as in scrofulous cases, or homogeneous and healthy, as in simple inflammation. In some cases it happened that these large sacs had no communication whatever with the smaller collection of matter in front of the denuded bone; and then the pus accumulated in these isolated positions was found, when the post-mortem examination was made, to be yellow, homogeneous, and inodorous, whilst that contained in the great abscess (supposing an external opening to have existed?) exhaled a fetid odour.

M. Dalmas, who collected a great number of cases under my direction, illustrating caries of the spine, made the remark that there was never any satisfactory relation between the amount of disease affecting the bone, and the extent of the external disorder. Indeed, in some instances, the bone was diseased at only a single point, whilst the affection of the neighbouring textures was very considerable; whereas, in other cases, five or six vertebræ were denuded and bathed in pus, whilst the surrounding parts were healthy.

Considered in the abstract, this caries consists in a simple denudation of the bone, accompanied by erosion, and consequent irregularity of surface: the dark colour is apparently an adventitious circumstance, dependent on the presence of air and the contact of pus. Sometimes there is an almost complete destruction of the body of a vertebra and the interarticular ligaments: more rarely there is thinning or wasting of the osseous texture. In one case only did the above-named gentleman observe, that the broken-down remains of vertebræ were reunited by irregular vegetations. It may be safely affirmed, therefore, that in the largest proportion of cases there is neither softening nor abscess in the interior of the bones: and in all instances, close to the denuded and eroded points, the neighbouring tissue preserves, with the single exception of colour, all its natural properties.

Thus, the anatomical changes may be referred to three heads: 1, an internal suppuration, the origin of symptomatic abscess; 2, deep-seated suppuration in contact with the bones, involving a separation of the adjacent fibrous textures; 3, change in the bones themselves.

According to this view, the cause and source of these abscesses is congestion in the areolar tissue alone, where they have their seat.[1] It is, indeed, impossible to admit that the pus is derived from the bones, since in several of the preceding cases, the enormous sacs about the trochanter and psoas had no communication with those which were in immediate connexion with the bone: and the decomposition of the pus is attributable to the introduction of air; for it was neither fetid nor sanious before an external opening was made. Moreover, prior to a communication being established between the deep and superficial collections of matter, the former still remained undecomposed. It is, therefore, fair to conclude that the formation of the symptomatic abscesses was strictly due to phlegmonous inflammation.

The other form of lesion, I mean the deep suppuration involving the separation of the fibrous tissues, admits of a similar explanation. The inflamed organs which secrete pus on their external surface, pour it out also on their deeper surface which is in contact with the bones. Hence the slow process of separation, which is the result of chronic periostitis: hence also the thickening, softening, and occasional destruction of these fibrous textures.

---

[1] [In the original "la cause et la source des abcès par congestion et uniquement le tissu cellulaire," &c. This, however, is nonsense. The "abcès par congestion" will be explained a little further on.—Tr.]

The disorganization of the bone itself is referable, apparently, to the same causes: the inflamed periosteum in the first place conveys an inordinate amount of nourishment to the osseous tissue, whence result exostosis, hypertrophy, and vegetations, which are nothing more nor less than exaggeration of the form and volume of the bone. At a more advanced stage, when the inner surface of the periosteum begins to pour out pus, the same structure which was a short time before over-nourished is deprived of the necessary materials for its sustenance, and the equilibrium between the vital processes of deposit and absorption being suspended, erosion, atrophy, and partial necrosis result. Thus, this condition of the bone appears to be secondary, and mechanically consequent on the disorganization of the fibrous tissues associated with it.

The collections of pus, to which I prefer giving the name of "symptomatic abscess" (commonly known as *abscess by congestion*), constitute a very serious, and often fatal, disease. Nevertheless, these abscesses may sometimes be controlled and ultimately cured, if the caries, and the chronic inflammation of the neighbouring tissues yield to appropriate treatment; such as moxas, cautery, medicines, and hygienic regimen. But here a natural question arises, whether the symptomatic abscess should be left to the unaided efforts of nature, or be made the subject of surgical interference. Sometimes, these sacs of matter will remain for years together, without undergoing any change or causing any mischief: the pus is gradually absorbed, until it entirely disappears. At other times, after the lapse of a longer or shorter time, a spontaneous opening is formed, the contents of the abscess are discharged, and are not reproduced. In another class of cases the pus, after a time, becomes converted into adipocere, a fact which has been proved by chemical analysis.

Some years since I had under my care a young man, with symptomatic abscess associated with caries of the spine, and accompanied by considerable curvature. The caries was cured by the use of moxas, cautery, &c.; but the abscess only diminished a little, and never disappeared. Five or six years afterwards this patient died of pneumonia; and on examining his body, the caries was found entirely cured, the curvature alone remaining: but the abscess was converted into a fatty, soft, unctuous matter, presenting all the physical and chemical characters of adipocere; and the sinus which extended from the carious part of the spine to the sac was contracted, and its continuity destroyed at some points: some of the same fatty substance adhered to its walls.

I think it is dangerous to open abscesses resulting from caries of the spine which has been cured, as you thereby risk the re-establishment of the original disease. It is preferable to leave them to natnre, whether the caries yield to treatment or not.

The ordinary way in which fistulous canals are formed may be illustrated by the usual progress of an urinary fistula. We will suppose that urine has accumulated in large quantity in a sac, that inflammation has supervened, and an abscess has formed: this speedily bursts, and a fistulous opening is the consequence. In the course of a short time the interior of this canal assumes a mucous character. Now if, soon after the opening of the abscess, a catheter had been introduced into the urethra, there would have been no difficulty in healing the fistula: but if six months or a year have elapsed without having recourse to this mode of relief, it becomes almost impossible to cure it, as the organization is then permanent, and the secretion furnished by the lining membrane is almost identical with that secreted by a mucous membrane.

But let us give a little more consideration to this subject. In the first place, I consider the terms "fistula" and "fistulous ulcer" as convertible; and regard the distinction which is made by some persons between them as arbitrary and useless. The continued passage of any fluid by an unnatural course, determines in the affected parts an organizing process, the object of which is the formation of a new channel, to which the name of fistula is applied, when it opens externally; and every cause which operates so as to favour or bring about the escape of any animal fluid (the blood excepted) from its natural passage, or which tends to occasion or sustain deep-seated chronic inflammation, may be productive of fistula.

Thus, a foreign body, caries, necrosis, fungoid degeneration of the ligaments or articular cartilages; destruction of areolar tissue and the consequent isolation of the walls of an abscess; chronic inflammation in the frontal or maxillary sinus, in the larynx or chest,—in short, in any permanent cavity; a wound or spontaneous opening into the air-passages, &c. &c., —are amongst the most common causes and promoters of fistula.

These diseases do not originally present the characters which they afterwards assume. They commence for the most part by an abscess, which discharges pus of various qualities, sometimes pure, at others mingled with a natural secretion. The exceptions to this mode of origin are rare, and consist of such fistulæ as are formed by the wound of an excretory canal. When this is the case, a simple or single sinus is the result; whereas, in the former and more common instances referred to, the accumulated fluid may force its way out at several points. When the abscess is near the surface the opening is direct; but when deeply situated, it may either open by one or several apertures, or numerous outlets from the sac may terminate in one common external opening: this constitutes the first stage of a fistula.

If the fistulous canal is short, the second stage is very simple: the inflammation subsides, the mouth of the sinus becomes accustomed to the contact of the secretion, and ultimately cicatrizes without closing. But the phenomena which attend the progress of fistula communicating with a deep-seated abscess are more complex. The walls of the cavity contract without adhering: the external aperture of the sinus also becomes narrower and rounded, so as ultimately to present the appearance of a small red fungosity, pierced in the centre by an opening so small as to be difficult sometimes to detect, being more contracted than the canal of which it serves as the outlet: and the quantity of pus which is thence poured out, is entirely disproportioned to the *apparent* capacity or caliber of the latter. At the same time, the neighbouring tissues, bounding the course of the fistula, are involved in inflammation, which diminishes in activity as the walls of the sinus itself become habituated to the presence of the irritating secretion: and in the course of time this inflammatory action yields to an organizing process, by which the interior of the sinus is converted into a tissue in every respect resembling true mucous membrane, if we except the absence of follicles and an epidermis: at least such is the case in most instances.

In some cases where the inflammation is very moderate, the organization of the canal is so complete, that it is surrounded on its exterior by areolar tissue, analogous to that which is found around natural excretory ducts, and to which anatomists have given the name of "submucous cellular tissue:" but for the most part the surrounding textures are thickened and indurated. There is scarcely any tissue which is exempt from the chance of being involved in the constitution of these sinuses; and they may have their seat in almost every organ possessed of a parenchyma, even in the brain itself.

It was from acting under the erroneous impression that the induration alluded to was schirroid, that these fistulous canals were formerly extirpated: but we now know that this condition is one which is merely incidental to the peculiarity of the disease, and which disappears with the cessation of the cause to which it owes its origin.

There are, however, occasional deviations from the course which we have just traced. In some cases, for example, of caries of the spine, the pus is collected in a cyst in the immediate neighbourhood of the diseased point of bone. As the accumulation goes on the pus gravitates, and pushes before it the lower extremity of the cyst, which alternately expands and contracts, as it happens to meet with obstacles or not; and ultimately opens externally.

From what has preceded, the following inferences may be drawn: 1. That during their early stage, fistulæ may be cured by simply removing the causes on which they were dependent for their production. But, secondly, that when organized and possessed of a secreting mucous surface, there are further indications to fulfil: not only must the original exciting cause be withdrawn, whether it be in the form of caries, or of chronic suppuration, or consist in the presence of spicula or other foreign bodies or fluids; but the effect also of these irritants must be attacked, namely, the permanently organized character of the lining membrane of the sinus: and the desired object is to be attained by the employment of caustic injections, compression, &c., which have the power of changing the mucous character of the secretion, and procuring adhesion of the opposed walls of the fistula. As to the surrounding induration, this, as I have already remarked, usually subsides of itself: but if troublesome, it may be readily dispersed by rest, emollient applications, &c.

Though the mucous lining of a permanent sinus presents in most respects the features which characterize the true mucous membranes, an inquiry into the peculiarities which complicate the latter will best resolve the question, how far the false membrane is capable of attaining to the same degree of perfection as the natural tissue. Now, the true mucous membrane possesses a spongy bed, largely provided with blood-vessels, and resting on a cellular layer of varying density, from which it can be detached; it also presents an epidermis (epithelium) supplied with follicles, and frequently with a villous surface: and lastly, it is characterized by a peculiar fluid (mucus) being continually secreted by its surface. As compared rather than contrasted with the above, the tissue of accidental canals is soft, spongy and velvety, and of different degrees of density: it is without fibres or cells, and possesses neither elasticity nor extensibility; its colour also varies from a gray to a deep red or black. The adventitious membrane is susceptible of inflammation as are the natural mucous membranes: but the adhesion of the former to the subjacent areolar tissue is such as to render it difficult to separate them: yet it possesses even this character in common with some of the normal mucous canals; and the presence of an epithelial covering and follicles is not wanting, in some instances, to complete the analogy: at least such is the opinion I have been led to form from personal observation, though it is at variance with that of other pathologists. The secretion, lastly, of the normal and accidental membranes appears to be identical in constitution and function.

Sometimes there is a natural tendency to the cure of these fistulous canals, and in the following way. When no longer traversed by a fluid (whatever may be its nature), the component tissues of the sinus gradually contract, until its walls coalesce, and the canal is obliterated, leaving only a fibro-cellular cord to mark its original course. And even this cord ultimately disappears, and thus all trace of the existence of the disease is removed, as I have witnessed in several cases which I have had the opportunity of examining after death. The following is a remarkable example in point.

A woman was brought to the Hôtel-Dieu with strangulated hernia, the consequence of which was an artificial anus: and there could be no doubt existing that the intestine became adherent to the abdominal parietes. Two years afterwards she was again admitted with another disease which proved fatal, and a post-mortem examination ensued. At first no adhesions could be discovered, but after a time a cord was found passing from the intestine to the upper part of the crural arch.

Again, in the woman who forms the subject of the first case, the old sinus had diminished in volume, whilst that of more recent date was of much larger caliber. The albuminous matter also which was found in the interior of the former was similar to that of false membranes, and was doubtless the medium by which reunion was to be effected. Occasionally, though but rarely, natural mucous canals are obliterated; and the greater facility with which accidental canals of the same nature adhere, appears to be dependent on the more perfect secreting properties of the former, and the larger proportion of villi they present.

For the cure of fistula, therefore, the requisite treatment should be adopted at as early a stage as possible: and the most efficacious method that I am aware of is, by the application of the actual cautery, or the employment of injections, such as nitric acid or nitrate of silver in water. These I have found very successful, especially in the treatment of sinuses of a scrofulous nature.

CHAPTER III.

EXOSTOSIS ON THE UPPER SURFACE OF THE UNGUAL PHALAN THE GREAT TOE. RARE CASES OF EXOSTOSIS.

It occasionally happens that the upper surface of the ung phalanx of the great toe presents a swelling, which has b commonly mistaken for a disease of the nail. A distinguis surgeon lately consulted me respecting his own child, un the impression that the nail was growing into the skin : on careful examination I discovered that such was not case, and that the disease was an exostosis in the situat above indicated. A similar instance was brought under observation a short time since at the hospital : a young wom was the subject of the affection ; and I removed the mor growth with perfect success. The details of the followi cases will afford a more exact view of this disease.

Case I. *Exostosis at the extremity of the great toe.*- Louise Emery, a semstress, aged 22, of good constitution a regular, born of healthy parents, and without venereal tai came to consult me in 1821. For two years this young wom had had an osseous tumour on the upper surface of the ung phalanx of the great toe, near to its outer border ; it was ve hard, and insensible except when very firmly pressed upo its broad base extended beyond the nail, which had been wo away by it. She could assign no cause for this mor growth, but said that it began, two years back, with pa about the extremity of the toe, which was aggravated walking and pressure : it gradually increased in size until attained its present magnitude. I recommended her to have extirpated.

Case II. *Exostosis of the last phalanx of the great toe.*- Catherine Loury, a semstress, aged 20, applied to me in 18 with a hard, osseous tumour on the outer and lower part of the left great toe: the progress of its growth had been very slow, as it did not exceed in size a small nut; and the patient could not account for its existence. The nail was a little raised by it, but it was not, in itself, painful, though it occasioned some inconvenience in walking. I removed this exostosis in the following way: the foot being fixed, I carried two semi-ovoid incisions around its base, and removed the greater part at once; some smaller portions were afterwards extirpated. The mass consisted of an external compact substance, and of spongy texture within. The wound healed in a few days.

Case III. *Exostosis of the great toe; extirpation, and cure.*—A young woman, aged 25, came to me with a tumour beneath the nail of the great toe: it had attained sufficient magnitude to raise and deform the nail, and to render walking very troublesome. She had consulted an expert farrier, who took it for a wart and cauterized it. This treatment rather tended to hasten the growth, and the nail ultimately became curved upon itself, so that its anterior extremity almost touched its root, and it was also rough and irregular: she then suffered considerably. This exostosis was cut down upon in the same way as the last, and removed with a bistoury: it was found to be very hard; but the operation was not attended with difficulty, and the wound speedily healed.

Case IV. *Extirpation of a fungous exostosis; cure.*—Françoise Thérasse, a semstress, aged 24, was admitted into the Hôtel-Dieu in 1817, with exostosis of the right great toe. She stated that, about a year previously, some one had trodden heavily upon her great toe, and that some blood was consequently extravasated beneath the nail; that an abscess afterwards formed, which had broken externally, and suppurated for some time; but this had not prevented her from walking. Three months after the accident, a small fungus sprouted from under the inner border of the nail, and continued to grow in spite of the repeated application of caustic: a ligature was subsequently applied around it, which only removed the surface of the morbid product; and as alum was afterwards employed with no more benefit she determined on coming to the Hôtel-

Dieu. The disease then exhibited itself in the form of a rounded, hemispherical tumour, about eight lines in diameter, entirely circumscribed and hard: it occupied the anterior half of the site of the nail, which had been split through its whole extent, and presented a fungous and reddened surface, with but little sensibility. Pus was secreted from the excrescence when the patient was at rest; but blood oozed from it, and great pain was occasioned when she walked. I treated this exostosis as I had the others which I have mentioned, by excision: it was firmly adherent to the phalanx, and consisted of compact and spongy texture; the exterior being covered by a layer of fibro-cartilage, from which the fungus sprang. It was deemed unnecessary to apply caustic to the wound, which was simply dressed; and in little more than a fortnight it was healed, and the patient was able to walk without pain or inconvenience.

CASE V. *Exostosis on the ungual phalanx of the great toe: extirpation, and cure.*—Louise Cassin, a laundress, aged 20, was admitted into the Hôtel-Dieu in 1817, with an osseous tumour, about the size of a large pea, on the outer border of the last phalanx of the great toe: the nail had grown into the back part of it, and occasioned pain. This morbid growth was removed with a bistoury, and the wound was afterwards cauterized: portions of the nail and necrosed bone afterwards exfoliated, and the patient quitted the hospital before she was quite well. This excrescence likewise presented an osseous nucleus.

The above affection has not been noticed, as far as I know, by any author. It is painful and inconvenient rather than dangerous; and its characteristics are such as the details of the above cases exhibit. I know not what cause to ascribe it to, for it usually occurs in individuals who have received no injury, and is apparently unassociated with a scrofulous diathesis or syphilitic taint. The morbid growth in question has been usually mistaken for a wart, and treated as such by cauteries, which are always, under these circumstances, productive of much mischief. The nail has in other cases been fixed upon as the seat of the disease, and removed accordingly, with, I need scarcely add, no beneficial effect. The structure of the excrescence is such as I have already described: it usually yields to the knife, but in some instances requires stronger instruments for its removal. If allowed to proceed, intractable ulceration ensues; and in one case of this sort I saw the ungual phalanx of the great toe entirely removed for this affection. In performing the operation, it may be occasionally necessary to cut away the nail, but this is usually uncalled for: care should be taken to extirpate the whole of the diseased growth, or it will be reproduced. It has fallen to my lot to operate on as many as thirty cases such as I have just described.

I shall now relate a few instances of exostosis in other parts of the body, which I think may be interesting and instructive.

CASE VI. *Large exostoses developed on most of the bones; ascites, followed by death.*—Clara Richard, aged 25, of scrofulous and feeble constitution, short stature, and suffering from amenorrhœa, stated that until eleven years old her health had been good; but that she was then attacked by an affection of the nose, which, at the end of six months, terminated in exfoliation of bone and partial destruction of the organ. Four years afterwards a fresh disease appeared in the same part, for which a portion of the lower turbinated bone was removed, under the impression that it was a polypus. She was seventeen years old when the first exostosis appeared on the leg, since which it is probable that others successively made their appearance; but their progress was not noticed by her. When she came into the hospital, she had a cough, with hemoptysis, and swollen belly and extremities: the body was wasted, and exostoses covered the bones of the limbs; those in the fore-arm rendering its rotation impracticable. The heavy head fell, like a dead weight, on the breast or shoulders, the patient supporting it by a pillow. She was treated in the first place by mercury given internally, and afterwards by mercurial frictions, but the symptoms were only aggravated. Ascites supervened, and she sank, and died in little more than a month after her admission.

Autopsy.—When the skeleton was prepared it presented the following appearances. The phalanges of the toes and the tarsal and metatarsal bones were without trace of exostosis: the tibia of either side was enlarged through three fourths of

its extent, the upper fourth alone being of its natural volum
the posterior surface of the patellæ presented exostoses. The
was some calcareous deposit about the lower part of the le
thigh, but no bony excrescence; whereas the right thigh w
at least three times its natural volume through its lower tw
thirds. The pelvis, sternum, ribs, vertebræ, and hands were i
a normal condition. The left fore-arm presented exostose
which coalesced so as to consolidate the two bones, the radiu
being affected throughout its whole extent, and the ulna bein
healthy only at its upper extremity: the right fore-arm w
less affected, the morbid product being confined to the radiu
which was most free above. The left humerus presented
small exostosis at its lower extremity, and the right was healthy
the converse was the case with the clavicles: the jaws wer
unaffected. The bones of the head presented the most r
markable changes: instead of being comparatively light an
thin, as might have been expected from the patient's age an
arrested development, they were very dense: the coronal sutur
was more than eight lines through, and the temporo-pariet
regions were upwards of half an inch in thickness. Th
occipital region, with the exception of the fossæ, presented a
equivalent development: and the exterior of the skull generall
was rough and eroded, and would probably have soon becom
carious had the patient lived. The sutures were nearly unite
by ossification; and the roof of the orbit corresponded i
thickness to the other bones of the head.

Case VII. *Exostosis on either side of the nose.*—Hortens
Lefèvre, aged 32, a linen-draper, of feeble constitution, yet i
the enjoyment of moderately good health, was born of health
parents, but has been irregular in her catamenial periods sinc
the age of sixteen. Never having had any sexual intercourse, i
was a reasonable postulate that she was not the subject of vene
real taint. At the age of eighteen, she first perceived a sma
osseous prominence on either side of the nose, and in the cours
of two years these exostoses attained their full growth, whic
was about the size of small walnuts. Springing from th
junction of the nasal and superior maxillary bones, they ex
tended some lines beyond the central ridge of the nose, bein
very hard to the touch, and giving a ludicrous expression t

the face. The right enlargement a little exceeded the left, but they both projected inwards so as entirely to plug the nostrils, and render respiration by these inlets impracticable: the sense of smell was also quite annihilated, and the nasal twang imparted to the voice was very disagreeable. I should remark that there was neither deformity of the nostrils, nor epiphora.

One year after the first appearance of these exostoses, two more were developed anterior to the angles of the inferior maxillary bone: the looseness of the skin rendered these projections less observable, though they had attained the size of the thumb, and were oblong in form: they merely conveyed to the beholder an impression of great breadth between the angles of the jaw. The subject of these affections was short, and had the upper extremities very ill-developed: the deformities themselves had remained stationary during the last ten years. Nothing was done for her.

CASE VIII. *Large exostosis from the sixth rib.*—Jean-Louis Bonnefoy, aged 18, a shoemaker, came to consult me in 1818, in the following condition. From the outer two thirds of the anterior half of the sixth rib on the left side, there sprang a thick crest or ridge, six lines in diameter from above downwards; which, after extending outwards for the space of half an inch, abruptly expanded into a large tumour that reached horizontally from the anterior margin of the deltoid to within a finger's breadth of the sternum, and vertically from the nipple to the third rib. This tumour was osseous and indolent, and presented the form of a semi-ovoid cut through in its greatest diameter. The greater part of its circumference was nodulated; and of its two diameters, the transverse measured about six inches, and the vertical four.

It was between the fifth and sixth year of his age that this patient first perceived the exostosis in question, which was then a small, hard tumour, about the size of a filbert: from that period it progressively increased in dimensions, at first slowly, but during the last five years much more rapidly. When he was dressed, the deformity was not very marked: and as he did not experience any interruption to his usual occupations from the morbid growth, and any attempt to remove it must necessarily have been attended by considerable risk, I recommended him to retain it; which, after some reflection, he consented to.

Case IX. *Exostoses on nearly all the bones.*—Alexis Daube, aged 18, a gardener, in good health though not very strong, and of a middling stature, was born of healthy parents, who state that he was well formed at the time of his birth, and that his brothers and sisters are free from any deformity. Whilst still at the breast, some of the vertebræ and bones of the lower extremities became the seat of exostoses. The exact order in which these morbid productions were developed had not been attended to; but the parents said that the greater number appeared when he was quite young, and grew with his growth. At the time I saw this patient, he presented the following appearance.

The bones of the head and face were healthy and natural. The spinous processes and laminæ of the last three or four dorsal and upper two lumbar vertebræ were nodulated in a remarkable manner, so as to appear like a string of large beads. Behind the anterior superior spine of the ilium was a small circumscribed exostosis, about the size of a hazel nut. The right clavicle presented, near its sternal extremity, a very small styloid exostosis. The left humerus appeared to be augmented in volume at its upper part only, the deltoid being thereby raised and rendered tense: but the right humerus had growing from it an osseous tumour, about the size and form of a large pomegranate: it was very circumscribed, and its surface was uneven and knotty. This exostosis seemed to spring from the part of the humerus which is opposite the anterior border of the deltoid: the muscle itself was pushed backwards by it, and it projected from under the anterior wall of the axilla. The condyles of either humerus were abnormally prominent. The radii were healthy, but there were one or two nut-like projections of bone from the ulnæ, behind and internal to the styloid process of each: the condition of the hands was normal. The lower fourth of the shaft of each femur, as well as its condyles, and the upper half of either tibia presented enormous exostoses, more or less circumscribed and prominent beneath the skin: their form might be not inaptly compared to irregular, knobby potatoes. The upper extremity of either fibula also was enlarged and deformed. The lower part of both tibiæ and fibulæ were simply increased in volume, so as to render the legs as clumsy below as above. The feet were, like the hands, in a perfectly normal state.

I have seen a considerable number of cases belonging to the above class, and am not disposed to attribute them to the influence of a venereal taint. The morbid growth seems to be simply referable to some irregularity in the nutritive process; the cause and effect being probably associated, as it is in instances of similar excrescences growing from certain trees.

CHAPTER IV.

ON OSTEO-SARCOMA, SPINA-VENTOSA, AND TUBERCLES IN BONE.

In speaking of osseous cysts, I mentioned that they may be confounded with osteo-sarcoma, and accordingly I pointed out the distinctive characteristics by which each of the diseases may be recognized. The diagnosis in these cases is, in truth, of the greatest importance, on account of the consequences entailed, and the appropriate treatment which each demands.

Osteo-sarcoma, which is a true cancerous degeneration of bone, manifests itself in the form of a white or reddish mass, lardaceous and firm at an early stage of the disease; but presenting, at a later period, points of softening, cerebriform matter, extravasated blood, and white or straw-coloured fluid of a viscid consistence, in its interior. These characters distinguish osteo-sarcoma from spina-ventosa, the two agreeing in exhibiting increased dimensions in the affected part; but this condition is dependent, in the latter, on swelling of the bone itself, attended by thinning and separation of its laminated texture. Towards their close these diseases present other points of resemblance; thus, it is not uncommon to find spina-ventosa passing into a cancerous state, or to see osteo-sarcoma accompanied by partial vascular or fleshy productions. In general, however, the one belongs rather to the class of fungous diseases, and the other to cancer.

Osteo-sarcoma attacks more particularly the jaws and the extremities of the long bones. It is also frequently observed on the iliac bones and in the neighbourhood of the acetabulum.

Case I. *Osteo-sarcoma of the lower-jaw. Excision; return of the disease; and death.*—A coachman, about 36 years of age, well developed and of lymphatico-sanguineous temperament, came to consult me in 1832. The lower jaw, especially on the right side, was enlarged; the skin was smooth, tense, and not adherent. On examining the interior of the mouth, the lower maxillary bone was found to be the seat of the disease, being tripled in volume, soft, yielding to pressure, and crepitating slightly; the gums were fungoid and bleeding; and the mouth exhaled a fetid odour, arising from an admixture of blood and ichorous discharge.

This man, who was a habitual drinker, said that he had received a blow on the chin three months previously in a quarrel. He soon afterwards felt a dull pain in the part, which subsequently assumed a lancinating character: the bone then began to increase in size, and the constitution to sympathise in the local affection. I proposed that, as the disease was clearly osteo-sarcoma, he should submit to the removal of the lower jaw, to which he assented.

The operation was tedious and troublesome. A vertical incision was first carried through the lower lip down to below the chin, and the flaps turned downwards and backwards. By these means the extent of the disease was defined, and two further incisions were then made parallel to the bone. On removing the upper portion, the base of the jaw was thought to be healthy; the diseased parts only were, in consequence, removed, and the bone scraped, the work of exfoliation being left to nature.[1]

The loss of blood was considerable, and would probably have proved fatal to the patient, had not the actual cautery been in readiness and freely employed. After a few hours, the flaps were brought together, and the parts simply dressed.

This patient left the hospital, at the end of six weeks, apparently well: but it was subsequently ascertained that he died, six months afterwards, in La Charité, of a return of the disease.

The portion of diseased bone which was removed, was soft, red, and encephaloid in character. Though a blow was here the exciting cause of the affection, no doubt the predisposition to the disease existed in the system.

---

[1] [The editors remark that complete excision would have been preferable.—Tr.]

Case II. *Osteo-sarcoma of the upper part of the tibia and fibula.*—Pierre Lhuillier, aged 28, a married man, and mason by trade, came into the Hôtel-Dieu in 1824. This patient, who was of a sanguine temperament and robust constitution, began to suffer pain in the upper and inner part of the left leg, seven months prior to his admission into the hospital: this was severer by night than by day; and at first there was no external evidence of disease. At the expiration of a month a tumour began to make its appearance, at the upper part of the tibia, internal to the ligamentum patellæ. Four months afterwards a second tumour presented itself beneath the first; and this was in turn succeeded by a third. The previous existence of a venereal taint in the system induced me to direct attention to this fact in the constitutional treatment; but no amendment resulted. The upper and outer part of the fibula became subsequently involved in the disease; and he suffered severe pain down the leg even to the sole of the foot. As the extent, gradual softening, and nodulated character of the tumour admitted of no doubt regarding its carcinomatous character, I proposed amputation: but this the patient declined, and soon afterwards quitted the hospital.

Case III. *Osteo-sarcoma of the right superior maxillary bone.*—Jean Dobré, aged 48, a retired soldier, was admitted into the Hôtel-Dieu in 1824. He was of a lymphatico-sanguine temperament and robust constitution; and had been suffering for between two and three months from excruciating pain in the right upper-jaw, extending to the temple and forehead. On examining the mouth, it was found that the last molar teeth on the affected side, though apparently sound, were loose and ready to fall out, and as if implanted in a soft, spongy tissue: the alveolar processes were, however, but little swollen. The adjacent mucous membrane was a little raised, but not fungoid: the patient suffered also, though less acutely, in the left superior maxillary bone, and the pain was much more severe by night than by day.

After remaining in the hospital for some time without amendment, Dobré himself suggested the trial of some anti-syphilitic medicines, as he had been some time before the subject of venereal disease. Contrary to expectation, the pain was materially relieved, and he continued, during the two months that he remained in the hospital, to improve, though the teeth were still loose, and the bone soft, when he left.

Case IV. *Osteo-sarcoma of the left superior maxillary bone.*—Michel Chaillon, aged 25, of delicate constitution and nervous temperament, was admitted into the Hôtel-Dieu in 1824. Two years previously he had been attacked by pain in the left upper-jaw-bone, for which he had several teeth extracted without relief. The part began to swell, and frequent discharge succeeded; the jaw from this time remaining permanently enlarged. Two months before his admission the tumour had been incised inside the mouth, and blood and pus followed; and after the lapse of some time the actual cautery was applied to the opening. From this period the tumour made progress, and the eye began to be pushed from its socket.

When admitted, the swelling extended from the middle of the masseter muscle upwards, where it encroached on the orbit, producing exophthalmos, the eye, however, preserving its transparency. The left nostril and entire nose were thrown towards the right side. The tumour itself was of a fibro-scirrhous hardness. At the back of the mouth, external to the alveolar plate, was a broad, deep ulcer, with fungous margin, from which blood and pus at times flowed: and there was a small abscess beneath the lower eyelid. Opiate applications were employed, and anodynes given internally, but there was no improvement whilst the patient remained in the hospital.

The prognosis in these cases is necessarily unfavorable for the most part; the disease being rather constitutional than local, and likely to return after operation. In some instances, however, the removal of the diseased parts has been attended with a satisfactory result.

Case V. *Osteo-sarcoma of the left superior maxillary bone; removal of the jaw, and ultimate cure.*—Louis Treffière, aged 54, a widowed labourer, very tall, and of pretty good constitution and general health, perceived, four or five years back, that he had a small, hard tumour within the left alveolar arch; to this he paid little attention, as it gave him but slight pain, and was attributed to the presence of decayed teeth. At a later period the tumour enlarged, and the whole alveolar ridge appeared swollen: it was then necessary to remove some molar teeth, which were loose, and in a measure forced up from their sockets. As the pain at this time increased, a medical man to whom he applied recommended him to apply leeches on the tumour, within the mouth; and so great was the relief experienced from their employment, that for some months the patient thought himself cured. Fifteen months prior to his admission, dull pains again attacked the jaw, and the tumour spread both backwards and inwards, so that he could no longer masticate on the affected side, and his articulation became indistinct. Leeches were again applied, but without benefit, and he ultimately came to Paris, and was admitted into the Hôtel-Dieu.

His state of health was then pretty good, and he ate and slept well. The jaws were separated, so that the saliva flowed out, and he spoke as if his mouth was full: the left cheek was swollen and hard, but not tender. When the mouth was widely opened, a tumour nearly the size of a fist presented itself, extending from the soft palate on the left side, to the corresponding alveolar border, which was much depressed: the velum itself was much swollen; and the tumour was deeply indented by the teeth of the lower jaw which were all perfect. This tumour was nodulated and covered by the mucous membrane, being devoid of vegetations or ulceration. Its consistence was not uniform, being at some parts hard, in fact osseous, and at others soft and yielding to pressure, but not fluctuating. The pain was not acute but constant, the patient complaining rather of the inconvenience he experienced in swallowing and speaking, and of the blocking-up of the mouth: he expressed his willingness to undergo an operation if it were deemed expedient. It was clear that the disease was osteo-sarcoma, though at the time I speak of the growth was more osseous than sarcomatous, whence its indolent character: but, as its osteo-fibrous might speedily be converted into a true osteo-sarcomatous character, it was desirable to accomplish its removal before the lancinating pains announced this change.

Although, on a superficial inspection, an impression was received that the lower jaw was involved in the disease, a more careful examination proved that it was confined to the superior maxillary bone, but branched out to the malar bone above, and along the inner surface of the ramus of the lower jaw inferiorly; it did not implicate the posterior wall of the pharynx.

Shortly after his admission the celebrated Astley Cooper saw the patient, and agreed with me in the necessity and feasibility of the operation, which I accordingly performed in his presence.

My first incision was carried from a little below the left commissure of the lips to the anterior margin of the masseter muscle; the parotid duct, with the principal nerves and vessels of the face, being in the upper of the two flaps thus formed: three bleeding arteries were then secured, and the ligatures cut off close to the knots. The flaps being held back by assistants, the tumour was brought well into view, and I proceeded by separating the soft parts internally and externally, first with a straight bistoury, and then with a blunt-pointed one. Having reached the jaw its alveolar border was divided with the cutting forceps, the section being carried inwards and outwards so as to complete the division of the bone, after which the tumour became movable.

The patient had not lost much blood, but fainted from the heat of the theatre and pain: this delayed the operation for a few minutes; but when proceeded with, it was soon completed by drawing the tumour forwards, and dividing its remaining connexions behind. The void that was left was frightful enough; but the patient jocularly remarked that "they had cut off part of his head, and had made room enough now for him to eat." Scarcely four ounces of blood had been lost, yet the patient was blanched. The cheek flaps were immediately brought together by three points of twisted suture.

On examining the tumour it was ascertained that the whole disease had been extirpated, for the circumference of the parts removed was healthy. The anterior pillar of the fauces was attached to its back part, and with it a portion of the tonsil, which was granular and altered in structure, but not carcinomatous. As was anticipated, the osseous was found to predominate over the sarcomatous element of the disease, the centre of the tumour being a little softened, where the process of degeneration was somewhat advanced: in the alveolar arch were still some carious teeth, which, however, had been pushed from their sockets, and were imbedded in the soft parts.

Within a few hours the house-surgeon was called on account of arterial bleeding. Cold applications were employed after the clots were removed, but without effect: the sutures were therefore removed, and the bleeding was found to proceed from several small vessels. Actual cautery was repeatedly employed before the hemorrhage was arrested; and the flaps were then readjusted. For three hours all went on well, but then bleeding recurred: this time compresses were applied, and pressure was kept up for some time: after this there was no more bleeding.

During the following two days there was great swelling, which, together with the fear of secondary hemorrhage, induced the house-surgeon to apply leeches three times to the neck. From this time the tumefaction gradually subsided, the constitutional symptoms improved, and the pledgets of lint came away. On the tenth day the sloughs began to separate, and the critical period for secondary hemorrhage had now arrived: the patient was constantly watched.

Another week passed without any untoward symptom, when erysipelas of the face was ushered in by sickness and shivering. Fearing the effect of further loss of blood, an artificial crisis to the disease was procured by blistering the cheeks: already the needles had been withdrawn, and the sutures had fallen off.[1] The severity of the attack was thus averted, but the patient was left in a state of extreme prostration, from which he very slowly rallied under a more generous diet, and ultimately quitted the hospital in pretty good health, two months after the performance of the operation. There was a linear cicatrix, three inches in extent, on the left cheek; and on the same side in the mouth, an enormous cavity, which had, however, begun to contract, and presented no appearance whatever of return of the disease. Since the attack of erysipelas he had been affected with deafness, which was probably due to an extension of the inflammation to the organ of hearing.

In the above case this malignant disease developed itself without apparent cause, in a healthy person, in the full vigour of life. These circumstances should, of course, have their due weight in determining the expediency of an operation: the manual part was much facilitated in the present instance by the preliminary free incision of the cheek.

---

[1] [A late proceeding, if removed only at this stage: the omitting to remove sutures at an early period is much to be deprecated, and is alone sufficient in some instances to induce erysipelatous inflammation.—Tr.]

Case VI. *Enormous osteo-sarcoma of the left thigh; amputation; and death of the patient.*—A female, named Henry, aged 43, of a nervous and bilious diathesis, had been frequently the subject of scabies and syphilis, of which she had been quite cured, when she married a soldier, whom she accompanied into Spain, Russia, and England. During these travels she became the mother of six children, and her general health was good. In 1814 she wounded her left knee by a fall, but was enabled to resume her usual occupations in a few days. Nevertheless, a few weeks afterwards this knee became the seat of dull and frequent pain, though there was no appearance of inflammation. In three months the lower part of the thigh began to enlarge, and soon increased rapidly, with lancinating pains, and her health fell a sacrifice to her suffering. Nearly two years elapsed from the period of the disease first becoming established, before she applied for admission into the Hôtel-Dieu.

At this time four fifths of the thigh were involved in the disease, the tumour being two feet in circumference. Its whole surface was hard and shining, except internally where it was a little softened. The skin was so tense that it appeared ready to burst: internally and externally the form of the distended condyles could be distinguished. Beneath the skin there were numberless large and tortuous veins. The patella seemed to be sound; the knee-joint was movable; the leg was not œdematous, and the hip-joint was not at all implicated in the disease: the soft parts in the neighbourhood for some inches down the thigh were also healthy. There was extreme emaciation, and other evidence of great prostration. The patient herself was anxious to get rid of the limb.

As the operation was contemplated, a question arose as to the propriety of amputating at the hip-joint, and how this proceeding should be accomplished. I made some experiments to satisfy myself on the latter point, and sought the counsel and opinion of several surgeons, especially of M. Petit, and finally arrived at the conclusion that it would be better, if the bone proved sound, to amputate a little below the joint. The operation was accordingly performed in the following way.

The external iliac artery being compressed against the pubes, I stood on the outer side of the limb, and made a circular incision through the integuments about seven or eight inches below the groin. An assistant aided in retracting the skin, whilst I proceeded with the division of the muscles: but before this could be completed, the struggling of the patient caused a large quantity of blood to be lost. The femoral, profunda, circumflex, and obturator arteries were tied, and then the hemorrhage ceased. The bone, which appeared healthy at that spot, was sawn through at the base of the smaller trochanter. Several other ligatures were then applied on arteries which had been divided in concluding the section of the muscles; and when the wound was dressed, the patient was carried back to bed.

The muscles, vessels and nerves of the thigh were flattened, but otherwise healthy: the caliber of the artery was somewhat diminished. The knee-joint was healthy.

The tumour, when separated, was found to weigh about ten pounds; and was white, nodulated, shining, and inclosed in fibrous tissue: at its inner and back part were several points of degeneration. It sprang from the lower fourth of the femur, principally the condyles, and was contiguous to it as high as its upper third. When the bone and tumour were divided from before backwards with the saw, the latter was found to consist, throughout the greater part of its extent, of fibrous and filamentous tissue, containing serum. Posteriorly there was a large abscess. Between the condyles and shaft of the femur there was an oblique solution of continuity, which had been reunited by fibrous tissue. The medulla was at many points almost fibrous in consistence, red in some places and yellow in others.

It is unnecessary to trace this case through the details of the daily reports: suffice it to say, that for a time she appeared to be going on well, and the stump had a healthy appearance; but that subsequently the powers of the system succumbed, the spirits became depressed, and she died in a state of prostration on the thirtieth day after the operation.

Autopsy.—Of the large intestine, the cæcum and colon especially were inflamed. There were two abscesses beneath the skin of the stump, and a third in the muscles near the bone. The areolar tissue surrounding the tied extremity of the femoral artery was ossified: all the arterial mouths were plugged with coagulum. There was a similar deposit extending along the whole of the femoral vein, occupying half its caliber: the outer surface of this clot was rather adherent to the vein, and it inclosed some pus at its lower part.

In the preceding case we recognize another instance of local injury being the exciting cause of a malignant disease. The death of the patient was doubtless caused by the internal inflammation. It may be added that the catamenia appeared some days after the operation, but only continued during twenty-four hours.

Case VII. *Osteo-sarcoma at the upper part of the right thigh; death of the patient.*— Eléonore Bouin, aged 15, had suffered in her earliest infancy from enlarged glands in the neck. At thirteen years old she first experienced severe pain in the right thigh, and began to menstruate when fourteen and a half: some months afterwards the right knee became the seat of suffering. This part was blistered with temporary relief; but, as the disease made progress, she was soon afterwards admitted into the Hôtel-Dieu in 1816.

At this time the upper part of the right thigh was one third larger than the left; the tumour extending on the outer side from the crest of the ilium, and insensibly diminishing as it approached the middle third of the thigh. Anteriorly the groin formed its upper boundary, but its limit was not so abrupt either internally or posteriorly. The surface of the tumour was slightly nodulated, and for the most part firm and resisting. The hip-joint could be moved without pain.

I came to the conclusion that the bone and periosteum were the source of the disease, for the femoral artery passed in front of the swelling; and that the hip-joint was sound. Baths and emollient applications were prescribed.

The bathing did not agree with the patient, and the tumour rapidly increased in size during the succeeding fortnight; after which something like obscure fluctuation at a considerable depth was perceptible. This became more sensible at the close of a month, approaching the surface, and increasing the tension of the skin: the poor child suffered severely, but with resignation.

At the end of six weeks the leg became œdematous, the pain was excessive, and the skin ready to burst. I had hitherto refrained from making an opening into the tumour, under the impression that the perception of fluctuation was not indicative of the presence of pus, for the points of softening had no communication with each other. But I now passed a small bistoury to some depth into the swelling, and nothing but dark blood escaped, by which I was satisfied that my diagnosis was correct. A probe could be passed into the opening to a depth of between two and three inches, the structure it penetrated being soft and diffluent. I had no doubt the disease was carcinomatous, and that all which could be done was to palliate the patient's sufferings. She died before the expiration of two months from the period of her admission; remaining calm and resigned to the last.

Autopsy.—The skin of the enlarged thigh was tense and thin, and the areolar tissue converted into a sort of fibrous layer, connecting the integument to the distended fascia lata, through which fluctuation was perceptible to the eye on pressing one point of the tumour. The femoral vessels were raised from their natural position, but healthy. Some of the muscles were merely wasted, but many of them were reduced to a substance resembling wine-lees. When these were raised, a white, nodulated, and resisting tumour was brought into view, surrounding the upper third of the thigh, and about six inches in diameter. Its upper extremity extended as high as the capsule of the hip-joint, and its lower was continuous with the periosteum, which was detached, red and flabby for some distance down. A sort of fibrous investment inclosed the tumour, which latter, on section, proved to be not uniform in structure or consistence; its texture being at some parts fibrous and firm, at others soft, generally white, and resembling somewhat the substance of the brain: with this some osseous lamellæ were found mingled. This cancerous degeneration seemed to be formed at the expense of the bone and periosteum. The femur itself was eroded from the bifurcation of the linea aspera to the base of the head. The great trochanter was unchanged where it gives attachment to the glutæus medius. The cartilaginous surfaces of the head of the bone and acetabulum were healthy; but the cancellated structure of the shaft was white, and more dense than natural. The viscera were healthy.

The only question in cases similar to this is, whether amputation at the hip-joint is justifiable. In the present instance it did not seem admissible on account of the disorganized and atrophied condition of the soft parts.

CASE VIII. *Disease of the knee; osteo-sarcoma of the femur; and death of the patient.*—Marguerite Mabille, a foundling, aged 21, accustomed to work in the country, had always enjoyed good health until the close of her first pregnancy, which terminated favorably in 1806.

A week before her confinement she complained of acute pain in the left knee; but this soon subsided, and reappeared three days after her delivery, accompanied by slight swelling of the part. From this period the disease made progress; the swelling and pain increased, the limb became generally œdematous, and the superficial veins varicose. At the time of her admission the tumour measured a foot in diameter, and involved the lower part of the femur and knee; its surface presented many varicose veins, and some points of superficial ulceration where in contact with the pillow on which it rested. The catamenia had ceased since the commencement of the disease. Anodynes were prescribed to assuage the pain; but she soon afterwards died in excruciating torment.

Autopsy.—On examining the limb, the disease was found confined to the femur; the tibia, fibula, and all the cartilages of the knee-joint being sound. Nearly the lower fifth of the femur was converted into a white, fibro-cellular mass, rather dense at some points, but softened and almost purulent at others: some spicula of bone were scattered here and there through this structure, constituting the only remaining traces of the femur at its lower part, and thus offering a marked contrast to spina-ventosa, in which disease the distended bone forms a sort of osseous network around the tumour.

In directing attention to the characteristics of osteo-sarcoma, I mentioned that there were some signs common to it and to spina-ventosa, and that the two diseases might be confounded towards their close, of which the following case will serve as an illustration.

CASE IX. *Spina-ventosa of the humerus. Analysis of the matter contained in the tumour, by Vauquelin.*—Jacques Courageux, aged 49, a literary man, of bilious and sanguineous temperament, had attained the age of forty-eight without having suffered from any disease save a gonorrhœa many years before. A severe contusion of the anterior part of the right shoulder was the apparent commencement of his present disease. The immediate effects of the fall in question were recovered from, but eight months afterwards the joint became the seat of severe pain, accompanied by immobility; and a fixed, hard tumour soon appeared on the external border of the acromion near its humeral extremity: the tumour itself was about the size of an egg, and not the seat of pain; neither was the skin covering it changed in colour. About this time he again fell and injured the affected arm so as to render it quite useless; in consequence of which he placed himself under the care of M. Pelletan in the *Grand Hospice de l'Humanité.* The pain was assuaged, and the use of the arm restored by the use of emollient applications. The tumour, however, increased in size.

So rapid, from this time, was the growth of the tumour, that in the course of a month it extended along the outer side of the arm to within an inch of the olecranon: severe pain had returned, and the shoulder-joint was perfectly fixed. Towards its upper part the skin became thinned and inflamed, obscure fluctuation being perceptible: and the whole mass was slightly movable. The arm was œdematous, the axillary glands were enlarged, the pulse was feeble and irregular: in other respects there was not much constitutional disturbance. The circumference of the tumour at the upper part of the arm, where it was most prominent, was about twenty-three inches.

Many surgeons who saw the patient coincided in the impracticability of benefiting him by operative interference, and palliative measures alone were accordingly adopted. After he had been in the hospital three months the tumour had increased, its whole surface being overspread by varicose veins, and the skin delicate, tense and shining. The fore-arm was only slightly infiltrated, and the elbow and wrist joints were still movable, though with difficulty. The surface at one point was excoriated, and the patient's suffering was augmented : indeed, he was becoming sensibly more feeble and emaciated.

During the progress of the disease, the smooth skin covering the tumour became rough, hard, and tuberculous, and the excoriated point, gangrenous. The constitution sympathised more actively, and death ultimately put an end to his sufferings, two years and three months from the period when the tumour first made its appearance.

Autopsy.—The tumour, together with the upper-arm, clavicle, and scapula, weighed about thirty-five pounds. The axillary vessels and nerves were healthy, and occupied a position between the morbid growth and skin. The distended deltoid muscle covered the whole anterior face of the tumour; and the upper part of the right side of the chest was depressed as low as the fourth rib. A trochar was twice plunged into the tumour, but no fluid followed its withdrawal: but when incised externally, it was found to contain some thick, reddish gelatinous matter. The fascia of the arm was entire, but excessively stretched.

When the red and white matter, deposited in the tumour to the amount of about twenty-four pounds, had been removed, the weight of the parts was reduced to the natural standard. An immense sac inclosed this enormous quantity of foreign matter, the walls of which were about two lines thick, and tough. At various points there were osseous particles which adhered to its inner surface by filamentous tissue, and appeared to have been detached, at some time or other, from the diseased humerus: similar fragments were, indeed, still adherent to the latter.

Almost all the neighbouring muscles were altered in their form, relations, and texture. The humerus was lengthened an inch and a half; and its head, which was depressed two inches below the glenoid cavity of the scapula, was connected to this latter by bands of lax filamentous tissue, adhering to the opposed cartilaginous surfaces. The head was involved in the disease that affected the upper half of the bone, which formed an angle at its point of continuity with the lower half. The back part of the upper half was destroyed even to its medullary canal. A cartilaginous arch was almost all that remained of the head of the humerus; and the whole appearance of this part conveyed the impression of there having been at an earlier period an osseous cavity, formed by the dilatation of the medullary canal of the bone. The clavicle was unchanged: but there were several swellings connected with different parts of the scapula.

An analysis of the matter contained in the sac of the tumour was conducted by M. Vauquelin, the result of which proved that the principal part of this deposit was albumen; at least it possessed all its properties. It was inclosed in an envelope of areolar tissue, mingled with blood-vessels and, perhaps, a little fibrous matter. There was, however, some part of the matter in question which was insoluble in cold water, and more solid than the rest; no doubt this was owing to its having begun to coagulate in the sac during the patient's lifetime.

It would appear, then, from the above history, that a fall was the [exciting] cause of this terrible disease. Dissection subsequently proved that the disease [originated and] was principally located in the medullary canal. We may, therefore, reasonably infer that the affection was, in the first instance, spina-ventosa; but that, as it advanced, cancer invaded the tissues; and thus, in the end, the existence of osteo-sarcoma was manifested by the presence of the characteristic signs of that disease.[1]

CASE X. *Spina-ventosa of the index-finger.*—Jules Guérin, a journeyman, aged 18, came to consult me in 1833. He had two tumours on the hand, one on the second phalanx of the left index-finger, and the other on the corresponding metacarpal bone: the former has existed nine years, the latter was of much later date. The patient could attribute the disease to no particular cause, and his general health was good. The phalangeal tumour was as big as a very large hen's egg, and extremely hard: the skin covering it was healthy, though attenuated and much distended: the more recent tumour was the size of a hazel-nut, and as hard as the other. He rarely had any pain in the affected parts, the inconvenience occasioned to him being the only cause of complaint.

---

[1] [The above case, which is reported at length by M. Ruffin, has been curtailed, and the results only of M. Vauquelin's analysis given: further details would have been tedious.—TR.]

I anticipated that these tumours would prove to be either spina-ventosa or exostosis, but more probably the former: and that the excavated bone was filled with cancerous matter. In such case, the disease would most probably burst its existing barrier and attack the soft parts; therefore it appeared the wisest course to remove the affected part at once. But then came the question as to the removal at the same time of the metacarpal bone. My objections to this step were, in the first place, the doubtful nature of the disease, which might after all turn out to be exostosis; and further, that the sacrifice of a metacarpal bone or any part of it, is inadmissible where it can be avoided. I may here remark that the recommendation of some authors to remove even the projecting head of a metacarpal bone is to be deprecated, as this operation is attended with much more risk than the simple removal of the finger at the metacarpo-phalangeal articulation: and the same remarks are applicable to the corresponding operation on the foot: in either case the practice is a great abuse, and should be discountenanced.[1] Some operators have even advised the removal of the hand at the wrist-joint, where the fingers were the seat of cancerous affections: but the dread of the disease returning, which is pleaded as the reason for this proceeding, has been very unnecessarily exaggerated, as I have frequently proved in the course of practice.

Guérin's finger was accordingly amputated at the metacarpo-phalangeal articulation; and in a fortnight the part was entirely healed. On examining the affected phalanx the bone was found to be dilated and reduced to a mere osseous shell, thin and unresisting: there was no trace of medullary membrane, but the cavity was occupied by a grayish-white matter of thick consistence, something like lard, and contained in a number of small cells, formed of osseous lamellæ of extreme delicacy. This, then, was clearly a case of *spina-ventosa.*

---

[1] [The specific objections to the operation in question are not given by the author, but may be thus stated. As regards the *immediate* effects, there is injury to the palmar vessels and nerves, and the risk of troublesome hemorrhage: as regards the *remote* effects, there is impaired use of the hand, which renders the unnecessary sacrifice of the head of a metacarpal bone altogether unjustifiable, when the subject of the operation is a labourer or mechanic. Sightliness is the only argument in favour of the additional mutilation.—Tr.]

This disease forms one amongst a thousand illustrations of the errors and anomalies which spring from our not being guided by positive knowledge in pathological anatomy. The vagueness which still exists as to what is to be understood by the word *spina-ventosa,* an expression both barbarous and ridiculous, is such, that many writers of great merit have described, as examples of this disease, true exostoses or hyperostoses with thinning of the osseous tissue, whilst others have confounded this disease, in all its stages, with osteo-sarcoma.

Spina-ventosa is not a very common, neither is it a very rare disease: but, either it has not been made the subject of investigation after death, or the utmost that has been done consisted in preparing and preserving the bone, without a thought being given to the examination of the medullary membrane. Our museums are filled with preparations of this kind, which confirm the justice of M. Boyer's remark, that the skeleton of the disease has been studied, whilst the disease itself has been altogether neglected and lost sight of.

In true *spina-ventosa,* the medullary membrane is the primary seat of the disease, secreting, and itself ultimately converted into, a fungous, gelatiniform or lardaceous substance, sometimes chalky and of reddish colour, mixed with serum: by this the bone is distended and reduced to a mere shell. In fact, it is of a true fungoid character; and the dilatation of the bone is merely a mechanical effect of the disease, as in fungi of the antrum.

There is another disease of bones to which M. Nélaton has particularly directed attention,[1] namely, tubercles. Encysted tubercles in adults have been several times met with in the post-mortem examinations at the Hôtel-Dieu; but M. Nélaton first directed attention to tubercular deposit in bone, such as is met with in the lungs. He discovered this by removing the periosteum, and on observing a marbled appearance of the surface of the bone, he proceeded to saw off the external compact layer, and then sliced the bone with a strong scalpel; by which process groups of pearly granulations of an opaline white hue, and about half a line in diameter, were brought into view. These are found also to exist in a puriform condition. In the earlier stage vessels may be seen with a lens; but these disappear in the latter stage. The actual seat of the disease loses its vitality, and becomes a sequestrum which is disposed of by the organs of assimilation.

---

[1] Recherches sur l'Affection tuberculeuse des Os. 1836. [These concluding paragraphs are evidently inserted by the Editors.—Tr.]

The difference between caries and puriform infiltration resulting from tubercular deposit is, that in the former the osseous tissue is rarefied, softened and permeated by vessels; in the latter there are hypertrophy and increased density, but no vessels. Lastly, the deposit of tubercle takes place in the substance, whereas caries almost always proceeds from the periphery, of the bone.

CHAPTER V.

ON THE CYSTS WHICH ARE DEVELOPED IN THE STRUCTURE OF BONE, AND THEIR VARIOUS KINDS.[1]

Some time since I was the first to demonstrate that certain tumours, ordinarily of a fibro-filamentous character, are developed in bones; and which, as they grow, raise and thin the bone, so as to reduce it to a mere shell, not thicker than a plate of metal beaten out with a hammer. When the subject of such an affection dies, the cavity in the bone is frequently found to contain fibro-filamentous matter, unless altered by a process of degeneration. This tissue appears to be altogether a new product; but it is remarkable that there is neither swelling nor softening of the bone, which is only distended and thinned: this point is of considerable importance in its bearing upon the diagnosis. The following interesting case will furnish a good illustration of the characteristics of the disease under consideration.

Case I. *Cyst developed in the osseous walls of the superior maxillary bone; operation, followed by death.*—A young girl, about 7 years of age, well-formed and of lymphatic diathesis, was admitted into the Hôtel-Dieu in June 1832, with a tumour in the upper jaw. She informed us that she had been struck on the cheek, and that after some time the part became painful and began to swell. On admission, the tumour had attained the size of the fist; the right nostril was obstructed and flattened, the palatine arch was driven upwards and towards the opposite side, and the eye was forced forwards. During the last month she had evidently fallen away.

At first sight I was disposed to regard this disease as osteo-sarcoma, for its development was attended with swelling and apparent softening of the bone, which signs are characteristic of the class of cancerous affections. Nevertheless, there was one symptom which raised a doubt in my mind respecting the correctness of this diagnosis, and induced a belief that the case was not altogether hopeless and beyond the reach of art. I remarked that, when I pressed the fore and upper part of the tumour, it yielded and returned to its previous form with a crackling noise, like a sheet of parchment; and the same phenomenon was observable when the palate was similarly treated: I then concluded that it was an osseous cyst. I hoped this conjecture might prove correct, as the disease would then be within reach of the knife; though I was prepared for the possibility of the original character of the affection being modified, as we know that these morbid productions are liable to degeneration and change. There were also other signs which served to confirm me in the opinion I had formed; such, for instance, as the condition of the surrounding parts, which were healthy and unaltered; the displacement being solely due to the development of the cyst. The disease had been mistaken for an abscess, and caustic potash applied: its advanced state at the time of admission, and the risk of its assuming a malignant character admitted of no delay.

---

[1] [A foot-note appended to the present article, refers to a memoir on 'Osseous Cysts,' by A. Brière de Boismont, in the 'Journal complémentaire des Sciences Médicales,' for 1833.—Tr.]

With the view of determining the condition of the tumour, I made a superficial incision across it, and subsequently plunged my knife into it; this was succeeded by a gush of dark blood, which, however, soon ceased to flow; and on carrying my finger into the cavity, I found it filled with a soft substance which was easily broken down. It was this that had distended the bone little by little: and when I passed my finger in different directions, I was satisfied that it was in the interior of an osseous cyst, of which some parts were hard, and others thin and yielding. On the following day I made another incision into the tumour, internally and at its most receding point: this time about two ounces of blood were lost, and I succeeded in detaching with my finger a portion of the substance which filled the cyst. There was no more bleeding during the day; and I directed that a bark injection should be administered, and a gargle of mel rosæ used.

Ten days after the operation there was a sensible amendment; the parietes of the cyst had sunk in, and the volume of the tumour was much diminished: I had therefore reasonable hope that the little patient would do well. I at this time began to introduce my finger, at each dressing, into the cyst, that I might break down or remove its remaining contents; and some denser portions were thus taken away: but each time that this was done a little blood was lost, which, together with the discharge, weakened the child, and I was therefore obliged to desist. She rallied again for a time, and the cyst very gradually diminished in size, and its external wall became sufficiently firm to resist the pressure of the finger: but she ultimately sank, apparently worn out by the disease, and died in the fourth month after the operation.

Autopsy.—The cyst was reduced to about two thirds of its original size; and the ulcer resulting from the application of the caustic potash was healed. When the skin was dissected up, the floor of the orbit was found raised and flattened, and formed the chord of the arch described by the remaining portion of the orbit. The lachrymal canal was contracted, but pervious, and nearly horizontal in its direction: the palatine arch was thinned, and reduced at some parts to a mere membrane. On laying open the cyst with a saw we were surprised to find it empty; a sort of mucous membrane, half a line in thickness, lined its interior. The cavity itself was contracted by the development of enormous cells, similar to those found in the ethmoid bone, but much larger, and situated between the external and internal wall of the cyst: of these walls the former was hard and tolerably thick; but the latter was thin, brittle and papyraceous, as were also the parietes of the cells. The nasal fossæ were entirely forced into the thickness of the left cheek, and were deformed and narrowed; so that the child almost always slept with her mouth open.

This case serves well to illustrate the difficulties attendant on the diagnosis and prognosis of this sad complaint, by which the surgeon is forced to modify the course he lays down for himself, accordingly as unexpected circumstances present themselves. The general state of the patient and the size of the tumour were not very encouraging in this instance; but I have already stated the reasons which decided me to operate: and I may add that the earlier these cases are taken in hand, the better chance there is of success.

The contents of these cysts vary considerably; they may be either solid or fluid; but most frequently they consist of a fibro-filamentous matter. This, however, is not the only product which is found in the texture of bone, without involving this tissue itself; indeed, I know not of any form of encysted tumour that is met with in the soft parts, which may not also be seen occasionally in bone. Of these I may enumerate the following:—1, serous cysts without an especial envelope; 2, hydatids; 3, cysts containing pus,—a sort of encysted abscess; 4, collections of an oily nature; 5, tumours consisting almost exclusively of adipocere; 6, a fungous, areolar tissue, saturated with blood, apparently analogous to the fungus hematodes of soft parts; 7, bony matter distinct from the cavity inclosing it; 8, and lastly, tissues composed either of several of those already enumerated, or of others which have not yet been classified by anatomists. The analogy, therefore, between the cysts of bone and those of the soft parts is very close; the difference in fact being, that of the nidus in which they are formed.

CASE II. *Osseous cyst developed in the lower jaw; operation, and cure.*—A young man, who was destined for the church, but had been refused admission at college on account of a large tumour on his face, came to consult me some years since. I examined the tumour in question with great care, and satisfied myself that the seat of it was the right horizontal ramus of the lower jaw. When the walls of the cyst, which was of ovoidal form, were pressed on, a slight crepitation was perceptible, such a sensation as would be conveyed to the finger by pressing on a piece of very dry parchment. The absence of anything like fungous growth or lancinating pain, together with the excellent health of the patient and his earnest desire to get rid of this insuperable obstacle to his vocation, induced me to operate: I may add that I had a strong conviction that the disease would prove to be a cyst with bony parietes.

I first of all laid open the cheek by an incision extending from the commissure of the mouth outwards; and then a second incision along the ramus of the jaw laid open the cyst, from which a little reddish-coloured serum escaped, and a mass of fibro-filamentous matter was brought into view: this I succeeded in partially extracting with forceps and a hook; and the suppurative process, with the aid of repeated injections, completed the cure. The walls of the cyst gradually contracted, so that ultimately there was but a trifling enlargement left, and the cicatrix was scarcely perceptible.

I have elsewhere remarked that teeth are sometimes found in cysts inclosed in bone, of which the following is an instance. M. Loir exhibited to me an osseous cyst developed in the palatine process of the superior maxillary bone on the left side, the parietes of which were formed by the two compact laminæ of this process: the immediate cause of the existence of this cyst was clearly the reversed position of a tooth. In fact, the left canine tooth, instead of piercing the alveolar edge of the corresponding superior maxillary bone, had opened for itself a passage through the inner wall of this bone, and had, by its presence, given rise to the formation of a cavity of at least thrice its own volume, in the diploe of the above apophysis, where it had attained its full development: the root of the tooth pressed against the outer plate of the alveolar process.

Case III. *Encysted tumour of the lower jaw, containing osseous nuclei; partial excision of the parietes, and cure.*—I was some time since summoned to attend a young man, who had an enormous development of the lower jaw. A fistulous passage opened a communication with a cavity, in which some isolated spicula of bone could be distinctly felt with the aid of a probe. The surgeon in attendance, believing the disease to be necrosis, enlarged the opening and withdrew several of these supposed splinters, which, however, proved on closer examination to be osseous excrescences. The patient returned home before the cure was completed, and afterwards came back again in the same state. I then judged it necessary to make an extended opening at the base of the bone, where the tumour was most dependent; and was thus enabled to empty it entirely: the quantity of foreign bodies contained was surprising, and they were of an irregular, globular form, very hard, and consisting of osseous or cretaceous matter, similar in shape to the scoriæ which are scattered on the roads. A fistulous opening remained, which was a long time in healing, but ultimately closed.

Fluid products.—Fluid is sometimes generated in these osseous cysts, of which the following case is an example.

Case IV. *Osseous cyst developed in the jaw; incision, followed by cure.*—In 1828, the sister of a physician in the neighbourhood of Tours, between 20 and 30 years of age, came to consult me on account of a tumour, as large as a pullet's egg, which had become developed in the right horizontal ramus of the lower jaw: the patient had been impressed with the idea that she was suffering from osteo-sarcoma. I examined the tumour carefully and was induced to form a more favorable diagnosis, as the lancinating pains and other symptoms attendant on cancerous disease were absent, and crepitation was distinctly perceptible when pressure was made on the walls of the cyst. The patient readily acquiesced in a proposal to relieve her by operation. The tumour projected more internally than externally, and encroached on the cavity of the mouth so as to press aside the tongue; its development, indeed, appeared to have been provoked by the imperfect extraction of a carious tooth.

An incision was made through the wall of the cyst within the mouth, which was followed by the escape of a large quantity of bloody serum; and a solid mass, closely resembling and in every respect analogous to adipocere, was afterwards removed with the aid of a curette. No doubt this mass was the product of the fatty conversion of such animal substances as had found their way, in the course of mastication, through the alveolar opening from which the tooth had been withdrawn. A few injections, with poultices to the cheek, the abstraction of some blood, and a low diet, sufficed in the course of a few days to complete the cure: no swelling nor other deformity remained.

The causes which favour the development of osseous cysts are generally very obscure: sometimes their production has appeared to be referable to external violence, as in an instance which came under my notice, where a blow of the fist was the determining cause. In the case I have already narrated, the imperfect extraction of a carious tooth laid the foundation of the disease. Morbid changes in the roots of the teeth give rise to the formation of serous cysts, which are most frequently met with in the alveoli of the upper canines, and in some instances acquire a very large size; even equal to that of the antrum. In such cases the root of the tooth is found diseased and inclosed within the cyst, which adheres to the alveolar cavity, and (when small enough) usually accompanies the tooth in its extraction: but if left behind, a suppurative process is established, which continues for a long time. The fluid yielded by these cysts is sometimes very thick, and in other instances of a serous character; and their inner surface is as smooth as that of the serous membranes. Not infrequently the origin of these affections is an entire mystery.

The first signs which betray the existence of osseous cysts are discomfort, and pain that is sometimes of a dull and at others of an acute character, but rarely lancinating. After the lapse of some time, varying in different cases, the part begins to swell, and attains a bulk ranging from that of a bullet to that of the fist. This enlargement is due to the distension of the bone by the presence of the foreign body between its laminæ, which thus become thinner and less resisting, so as to yield to the pressure of the finger, like a piece of very dry parchment or a sheet of crumpled paper: this species of crepitation is a pathognomonic sign of great importance. In many cases, repeated pressure has caused the disappearance of this sign, the thin plate of bone which formed the wall of the cyst yielding permanently: but, should any doubt exist as to the real nature of the disease, the additional evidence obtained by puncturing with an exploring needle is sufficient to set the matter at rest.

These tumours, as before stated, have their seat in the substance of bone; they occur in the extremities of the long bones, in the bodies of the vertebræ, but most commonly in the bones of the face. Thus, for instance, they are developed in the rami of the lower jaw, in the alveoli of the upper jaw, as well as in the antrum and nasal fossæ: nor are the other bones exempt. I have myself met with them in the bodies of the vertebræ, in the condyles of the femur and of the tibia, &c.; and Sir A. Cooper mentions having seen one instance in which the tibia was thus affected, and another in which the humerus was the seat of the disease. J. L. Petit witnessed a similar case; and Lecat has recorded a very singular example of a tumour developed in the cranial bones, the contents of which were solely gaseous. In general it is the cancellated structure which is more particularly the seat of this disease; and cases of tumours inclosed within the fibrous exterior of the long bones are much more rare.

It has been stated that these tumours do not generally affect the tissues in which they originate; nevertheless, when they reach a certain stage of development they occasionally change their character, and the bone may participate in the mischief. Thus, a fibrous tumour may degenerate into an encysted scirrhus; and when this condition has existed for a length of time in the centre of the mass, it very rarely fails of reaching the cyst, and even the surrounding parts. The form of these tumours is generally ovoid, sometimes oblong, or even flattened; and their bulk varies from that of a musket-ball to a hen's egg; and sometimes they attain the size of the fist. Their parietes are formed by the bones themselves, in the interior of which they are developed.

To form a correct diagnosis of osseous cysts requires much practice and experience; but the difficulty is in part removed when there is no reason to suspect the existence of osteo-sarcoma: therefore, it is very desirable to establish what are the diagnostic differences between the tumours of which I am treating and osteo-sarcoma, with which on superficial examination they may be confounded, and from which it is so important to distinguish them. Osteo-sarcoma manifests itself from the commencement by lancinating pains, by varicose swelling, by the simultaneous change in the condition of the surrounding soft or hard parts; and by the fungoid character and numerous irregularities which the tumour presents. In osseous cysts, on the contrary, the neighbouring parts are not involved in the disease; their surface is smooth and even, and their growth is very slow. But the development of osteo-sarcoma is rapid; and this species of tumour is traversed by spicula or fragments of bone, which are never present in the other. In regard to the crepitation, which is peculiar to osseous cysts, it is very similar to that which I have perceived in tumours girt in the centre and divided into two parts by the palmar annular ligament; but with this difference that, in the latter, the crepitus is due to the sudden collision of these tumours, which I believe to be hydatids, against each other. Lastly, the employment of the exploring needle is a very useful aid in determining the nature of this affection as distinguished from osteo-sarcoma.

The following, then, is the summary of the practical inferences to be deduced from this distinction. 1. Osteo-sarcoma and osseous cysts differ essentially from each other. 2. Osteo-sarcoma is a cancerous degeneration of bone; whereas, the osseous cyst is only an enlargement of the bone, due most frequently to the presence of fibrous bodies, similar to those which are developed in the uterus. 3. When there is no degeneration, the tumour may be cured by the knife, without fear of its recurrence: but it is far otherwise with osteo-sarcoma; for the extirpation of the tumour is ineffectual, as the disease is cancerous.

Ordinarily the growth of osseous cysts is tardy; but in some instances they acquire a large size in a few months, whilst in others they remain stationary for many years. Sooner or later, if left to themselves, they degenerate into cancer; a condition to which those forms are especially prone, which contain fibro-filamentous matter. The contents of the cysts are very readily reproduced; and this will even occur two or three times, until they are entirely destroyed.

Case V. *Osseous cyst developed in the alveolar process of superior maxilla; twice operated on.*—A lad, 15 years of age, came to consult me on account of a tumour in the anterior part of the alveolar process of the upper jaw. On examining it with the finger crepitus was distinctly perceptible, and this sign led me to conclude that the disease was a cyst with osseous walls. A puncture was followed by the escape of a quantity of fluid; and I immediately afterwards opened the sac freely. My reason for so doing was, that the lad had been recently operated on; and, according to his father's account, a great deal of water had issued from the wound: in spite of which the disease had reappeared. My aim, therefore, was to destroy the secreting surface of the cyst by inducing a suppurative action: and I intended to have effected this by the introduction of pledgets of lint, and the injection of astringent lotions; but I unfortunately lost sight of the patient.

Case VI. *Cyst developed in the lower jaw, cured after three operations.*—In 1813, a youth, of the same age as the last, came to consult me at the Hôtel-Dieu, for a tumour in the lower jaw. This swelling occupied all the right horizontal ramus of the bone, and appeared to encroach on the vertical ramus of the same side: it was as large as a turkey's egg, extending beyond the base of the jaw, and forcing the teeth very much inwards; it was, moreover, advancing progressively in size. My first impression was, that the disease was exostosis; but on a more careful examination, it was found to yield at several points to the pressure of the finger. Having made up my mind to operate, I divided the mucous membrane of the mouth which covered the base of the tumour, and then laid open the tumour itself with a chisel and mallet: a rather thin plate of bone was thus divided, which inclosed a tumour of a different nature. I cut away a considerable portion of the fibrous substance which composed this structure, and the patient was then sent to bed. This morbid growth was, however, rapidly reproduced, and the tumour soon gained its original dimensions. I then again removed all that appeared in sight, and several times applied the actual cautery. Yet, in spite of these active measures, the fibrous structure in question speedily again sprouted forth; and this time, in order to make more sure of attaining my object, I exposed the whole of the base of the tumour, by an incision extending from the free border of the lower lip to the os hyoides, and by dissecting back the flap which covered the morbid growth. I then tore away with forceps a fibrous mass of a lobulated character and free, which occupied a very large cavity in the interior of the ramus of the jaw; and immediately afterwards cauterized the whole surface of the bone, whence the tumour sprung. The cure was complete; and I may remark that the fibrous matter I removed at these three operations, was identical in appearance with such as is found developed in the substance of the uterus.

The prognosis in cases of these osseous cysts resolves itself into the simple statement that they are all curable by operation. It is true, as the last case proves, that the reproductive tendency is very active where the secreting apparatus is not destroyed; but the knowledge of this fact enables the operator to employ the proper means for combating the difficulty. But the case assumes a very different aspect when the fibrous structure degenerates into cancer, and the surrounding parts participate in this change: a fatal termination may then be anticipated. In some cases there may be risk of hemorrhage; but the best way of avoiding this is to adopt the precautionary step of introducing an exploring needle. When the deformity is considerable, it is impossible to avoid leaving some traces of the previous existence of the disease; but this is too unimportant to deserve attention.

The basis of the treatment of these cases, therefore, consists in the evacuation of the cyst, and the employment of such means as tend to procure obliteration of the cavity. It is preferable in those cases where the face is the seat of the disease, to make the opening from within the mouth; and it is unnecessary to extend the incision beyond such limit as will readily admit of the contents of the sac being removed. The morbid deposit may be solid, in which case the employment of the actual cautery, as in the instance just now related, may be called for: or it may be serum, which may be allowed to drain away. But if there are hydatids, their fluid contents must be evacuated, and the cells themselves must then be extirpated. Finally, if the contents are of a consistence which renders it impracticable to remove them at once, they must be broken up from time to time, and the detached fragments washed away by injections. The subsequent treatment must be directed to the prevention of the recurrence of the disease: and this is to be accomplished by the introduction of pledgets of lint, and the employment of soothing or irritating injections, according to circumstances. This course rarely fails to establish sufficient inflammation in the cyst to destroy the secreting membrane which lines it; and the cavity itself is ultimately obliterated. Regulated pressure on the exterior of the tumour is efficacious in some cases; whilst in others, a counter-opening and the introduction of a seton are rendered necessary.

CASE VII. *Osseous cyst of the lower jaw, cured by seton.*— A man applied to me with a tumour near the left angle of the lower jaw, which was evidently a cyst with osseous parietes. With the view of ascertaining the nature of its contents, I introduced an exploring needle from the inside of the mouth, and drew off some fluid. I then extended the opening; and, as I could scarcely expect to obtain a cure by this step only, for the food and saliva found their way into the cavity, I made a counter-opening below and externally. The fingers could thus be readily introduced, so as to allow of my feeling a semi-fluid matter in the sac. A seton was then passed through the two openings; and in the course of a month after the operation the tumour was reduced to one half of its former size. Having thus satisfied myself of the non-malignant character of the disease, I was not solicitous about the time that might be required to effect a permanent cure. The after-treatment merely consisted in the application of poultices to the tumour, and attention to the diet of the patient.

Occasional bloodletting is in some instances requisite to subdue the tendency to inflammation. The following case affords an illustration of several points of interest.

Case VIII. *Cyst with osseous parietes in the lower jaw, cured by incision.*—A young woman came, in 1828, to the Hôtel-Dieu, to be treated for a tumour of the lower jaw: it was ovoid in form, and had attained the size of a pullet's egg. Its growth had been slow, unattended by lancinating pain, and without change of colour in the skin or other symptom of fungous disease; its greatest prominence was externally, and its position called for a variation in the mode of operating. Crepitation was at first distinct, but was afterwards for a time imperceptible, owing probably to the frequent manipulation of the tumour by those who examined it.

Shortly after the patient's admission into the hospital the following operation was performed. An incision was carried along the posterior border of the masseter muscle, commencing a little below its centre so as to avoid injuring the vessels and the facial nerve, and extending to the angle of the jaw. On separating the edges of this wound, the character of the cyst became more apparent: it was enveloped by a delicate membrane, apparently serous, and was smooth and without inequality or projection at any part. The anterior wall of the cyst was then laid open with a bistoury, and gave exit to a copious flow of bloody serum; but there was no appearance of any solid matter within. A pledget of lint was introduced between the edges of the incision to prevent reunion, and some emollient injections were administered and a poultice was applied.

In the course of a short time a free suppurative action was established in the interior of the cyst, which was frequently washed out with the syringe. A slight but unimportant blush of inflammation and swelling appeared on the cheek in the neighbourhood of the opening; and the pain which was at first experienced gradually subsided: the caliber of the sac also palpably diminished. So satisfactory was this progress that I did not attempt the employment of artificial pressure, being satisfied that the compression exercised by the masseter on one side and the pterygoids on the other, would suffice to accomplish the obliteration of the cyst. I had the satisfaction ultimately of witnessing this result, and the patient left the hospital quite cured, a small cicatrix alone marking the site of the incision.

Case IX. *Cyst with osseous parietes, and containing a fibrous tumour, developed in the substance of the lower jaw.*—A female, aged 16, was admitted into the Hôtel-Dieu in 1829, with a tumour in the lower jaw. She was well formed and robust, and as the morbid growth had been unattended with pain, there was good ground for inferring that it was neither exostosis nor osteo-sarcoma: I accordingly concluded that the disease was a fibrous tumour inclosed in a cyst of bone. The fibrous or areolar tissue is the most frequent seat of this form of tumour; which is often developed between the lobules of the parotid gland, and sometimes in the neighbourhood of joints: in the present instance the growth had taken place in the substance of the body of the lower jaw; and it had first made its appearance three months previously without any apparent cause. The progressive increase of the tumour had separated the compact tables of the bone, distended the gums, and forced out the first two molar teeth: it involved the portion of the jaw between the first and last molar teeth, and projected above the level of the alveolar processes to the extent of ten or twelve lines. The patient was unable to masticate on the affected side; and on making moderate pressure with the point of the finger on the prominence I could distinguish crepitation. Having thus sufficient evidence of the nature of the disease, I determined on attempting to relieve the patient by operation.

The patient's head being thrown back and supported by an assistant, I laid open the base of the tumour, first internally and then externally, by two incisions, which were parallel to the alveolar processes and met anteriorly. This proceeding at once exposed to view a whitish, fibrous body occupying the whole interior of the osseous cavity. The roof of the cyst being now raised, a lever was introduced so as to lift the morbid growth and bring it within the grasp of the fingers, when it was readily extracted, with but little suffering to the patient, and with the loss of scarcely an ounce of blood. The interior of the osseous cavity presented elevations which were lodged in corresponding depressions of the tumour. The latter, which was about as large as a pullet's egg, was irregularly rounded, hard, and elastic, and emitted a sound when divided by the scalpel: the small proportion of areolar tissue mingled with the fibrous element indicated that the existing tendency to degeneration was not to be dreaded.

No ill consequence followed the operation; but the osseous cavity gradually contracted, and was ultimately entirely obliterated. The patient quitted the hospital quite cured, and with a reasonable prospect of immunity from any return of the disease.

GENERAL INDEX.

- Abscess of the thigh crossed by the femoral artery, 395.
- Abscesses connected with caries of the vertebræ, 392 et seq. See also Vertebral Column.
- Abduction of the hand in fractured radius, 140.
- Acetabulum driven in by the head of the femur, 205.
- Adipocere generated in the closed sacs of abscesses, connected with caries of the spine, 402.
- Adjustment of fractures, 13.
- Adynamic affections following fracture of the fibula, 294; important distinction between different forms of, 294.
- Amputation of femur in a case of osteosarcoma, 33.
  - at the hip-joint, observations upon 423.
- Analogy between leg and fore-arm, 120.
- Ancients, practice of the, in fractures, 1.
- Angles formed by altered relation of bones in fractured fibula, 268.
- Ankle-joint implicated in fracture of the fibula, 284.
- Apparatus employed in fractures of extremities, 15.
  - for fractures of the patella, 229.
  - its tight application deprecated, 231.
  - employed in fractures of the fibula, with dislocation, 293.
- Arch, fractures of the zygomatic, 333.
- Arthrodial articulations, remarks on dislocations of the, 326.
- Astragalus removed in a case of dislocation, 244.
  - generally displaced inwards in fractures of lower end of tibia, 280.
- Astragalus, dislocation of the, partly reduced, 316; sometimes easily reduced, 317.
  - when dislocated, sometimes requires extirpation, 317.
  - mode of reducing, when dislocated, 318.
  - case of dislocation outwards of the, reduced, 319.
  - muscles should be relaxed to reduce the dislocated, 320.
  - position of the, may be reversed in dislocation, 321.
  - case of dislocation of the, followed by its removal, 321.
  - condition of the leg after removal of the, 323.
  - dislocation of the, reduced, 324.
  - note on Mr. Phillips's case of dislocated, 325.
- Atlas, dislocations of the axis and, 338. See also Vertebra.
- Atmospheric pressure in dislocation, 11.

- Bathing, cold, in congenital dislocation of the thighs, 177.
- Bed, most appropriate form of, for fractures, 9.
- Bell's, Charles, remarks on fractures of the fibula, 237.
  - discoveries on the nervous system, referred to, 358.
- Bell's, B., opinions regarding the reduction of old dislocations, 367.
- Bichat, Bordenave's theory respecting callus revived by, 41.
- Bladder, note on paralysis of the, in fractured spine, 354.
- Blood, extravasation of, a complication of fractured fibula, 285.

Bloodletting, note respecting, in fractures, 25.
Bone, condition of, at different periods of life, 2.
  disorganization of, in caries of the spine, 402.
  cysts developed in the structure of, 434. See also Cysts.
  tubercles in, 432.
Bones of the leg, mechanism of the, 239.
BORDENAVE's theory respecting the formation of callus, 40.
Brachial artery torn in attempting to reduce an old dislocation of the humerus, 368.
BRESCHET's case of dislocated ulna, 127, 151.
  opinion concerning causes of congenital dislocation of femur, 175.
  case of fractured patella, 228.
BROMFIELD's remarks on fracture of the fibula, 236-296.

Callus, provisional, in fractured cervix femoris, 199.
  how long in acquiring firmness, 18.
  resisting power of provisional, 24.
  liability to deformity of, 24.
  formation of, 40.
  provisional and permanent, 41.
  condition of, examined, 49, 52.
  experiments on the tenacity of, 57.
  methods employed in dissolving, 58.
  rupture of, deprecated, 71.
  permanent extension of, 71.
  section of, 71.
  rules relating to extension of, 71.
CAMPER's theory concerning the formation of callus, 40.
Cancer, influence of, in retarding the union of fractured bone, 28.
Cancerous diathesis, case of fracture in a, 31-2.
Capsule of hip-joint may be lacerated in fractured cervix femoris, 198.
Caries, of the vertebral column, cases of, 392 et seq. See also Vertebral Column.
  definition of, as affecting the spine, 401.
  difference between puriform infiltration of bone and, 433.
Cartilage, conversion of callus into, 44.
CASTELLA's remarks ón fractures of the fibula, 296.
  case of fractured fibula, accompanied by dislocation, 296.
Cautery, actual, used in caries of the spine, 397.
Cautions to be observed in extending callus, 72.
Cervical vertebræ, dislocations of the, 343-4.
Cervix femoris, fractures of, classed with oblique fractures, 21.
  opinions on reunion after fracture of, 22.
  prolonged treatment of fractures of, recommended, 22.
  fractures of the, 187: relative frequency of, in young and old, 187; Cooper's opinions on, 191-2; exciting causes of, 191, 196; why old women are most liable to, 190.
  fracture of the, from muscular action, 193; cases of, 193 et seq., see also Fracture; severe contusion may resemble, 197; lengthening of limb in, rare, 198; muscular action causes displacement in, 200; signs of, 201; distinguished from dislocation, 202; inversion of limb in, very rare, 202; usual consequences of, 204.
  direction of fracture in broken, 206.
  intra-capsular and extra-capsular fracture of, 207.
  obstacles to the union of fracture of, 209.
  transverse fracture of, easy to reduce, 211.
  fractures of, should be kept long under treatment, 211.
  sometimes little or no displacement in fractures of, 212.
  best method of effecting reduction in, 212.
  general objections to extension in fractures of, 213.
  apparatus best suited to fracture of, 214.
  rotation of trochanter on its axis, a sign of fracture of, 218.
  dangers attending fractures of, in old people, 219.
Characteristic signs of fracture of the fibula, 264.
Chest, depression of the walls of the, 383.
  characteristics of depression of the walls of the, 384.
  deformity of the, in young children, accompanied by enlarged tonsils, 385.

Chest, imperfect development of the skeleton accompanying deformity of the, 386.
treatment of deformity of the, 386.
cases of congenital depression of the, 388-9-90.

Clavicle fractured by spasm of sterno-mastoid, 38.
fractures of the, treated by position, 98, 101.

Clisse's method of reducing dislocated astragalus, 320.

Comminuted fractures of the fibula, 283.

Complications attending fracture of the fibula, 271. See also Fibula.

Compound fractures of the fibula, 286.

Congenital dislocation of either radius, 117.
of the thigh-bones, 165; palliative treatment in, 177; most common in females, 178; cases of, 178, 180-5; hereditary disposition to, 181; orthopedic treatment in, 184.

Cooper, Sir A., on non-union of fractured cervix femoris, 207.
remarks on fracture of the patella, &c., 231.
opinions on dislocation of the astragalus, quoted, 316.
opinion on the obstacles to reduction of dislocated humerus, 86.
on fracture of the lower extremity of the humerus, 117.
observations on dislocation of the ulna, 151.

Cord, disorganization of the spinal, in vertebral dislocations, 345.

Crepitus, a distinguishing sign of fracture, 89.
false, dependent on defective secretion of synovia, 90.
often masked by swelling, 104.

Cross, on non-union of fractured cervix femoris, 208.

Cruveilhier's case of supposed dislocation of the radius, 129.

Cubital splint in fractured radius, 140.

Cyst developed in the osseous walls of the upper jaw, 434.

Cysts, distinction between osteo-sarcoma and osseous, 435, 441.
nature of the contents of osseous, 437.
developed in the lower jaw, cured by operation, 437, 439, 443.
teeth sometimes found inclosed in osseous, 438.

Cysts, developed in the alveolar process of the upper jaw, 442.
causes which favour the development of osseous, 439.
first signs which betray the existence of osseous, 440.
the usual position of osseous, 440.
the diagnosis of osseous, 441.
prognosis in cases of osseous, 443.
in lower jaw, cured by seton and incision, 444-5; containing a fibrous tumour, 446.

Definitive callus, its resisting power, 25. See also Callus.

Depression of the walls of the chest, 383. See also Chest.

Desault, clavicle apparatus of, 97.
his plan of extension in fractured cervix femoris, 210.
his widow, case of (fractured cervix femoris), 219.
his mode of treating fracture of the fibula, 296.
his cases, in which he extirpated the astragalus, 323.

Diagnosis of fracture and dislocation at elbow-joint, 117.
of fractures of the radius, 133.

Direct fractures, causes of, 4.

Dislocation may be incomplete in enarthrotic joints, 73.
of humerus, reduced by Mothe's method, 74, 81, 82.
of the humerus in three directions primarily, 83.
of the humerus downwards, signs of, 84; forwards, signs of, 84; backwards, signs of, 85.
partial, of the humerus, 86.
of the humerus forwards, 92.
of the humerus, with fracture of the neck, 94. See also Humerus.
of fore-arm backwards, 110, 112; mode of reducing, 111, 113, 118.
of right elbow, of long standing, 114. See also Radius.
of the wrist, false notions respecting, 119.
of the ulna, 149, 150.
of the thumb, sometimes becomes irreducible, 154, 160; backwards most frequent, 160; signs of, 160; method of reducing, 160.
of the phalanges of the fingers, 161; often difficult to reduce, 162; position of flexor tendon in, 163; section of flexor tendon in, 164.

Dislocation, congenital, of the heads of the thigh-bones, 165; appearances on dissection of the same, 172; causes of the same, 173-6; palliative treatment in the same, 177; cases of the same, 178 et seq. See also Femur.
of the astragalus from a fall on the heel, 243.
of the foot backwards and forwards, very rare, 246; outwards, with fracture of the malleoli, 259; with fracture of the fibula, 269; inwards, with fracture of the fibula 274, 281; backwards, with fracture of tibia and fibula, 276; case of, 278; outwards, case of, 279; outwards and upwards, 282; inwards, with fracture of the leg, 297; means for reducing, 303; apparatus employed in, 303; backwards, means for keeping reduced, 305; case of, with fracture of the leg, 306; outwards, case of, terminating fatally, 310; statistics of, as complications of fractured fibula, 311 et seq.
of the astragalus, partial reduction, 316; see also Astragalus; treated by the removal of the bone, 321; reduced and cured, 324.
of the metatarsus, cases of, 326, 329. See Metatarsus.
of left thigh reduced after thirty-one days, 369.
of the humerus reduced after thirty-eight days, 370; reduced on the forty-ninth day, 371; reduced on the sixty-second day, 373.
of the left femur, reduced on the seventy-eighth day, 373.
of the humerus, reduced on the ninetieth day, 375.
of the thigh, reduced on the ninety-ninth day, 375.
of the humerus, reduced after six weeks, 377.
Dislocations of the vertebræ, 337. See also Vertebræ.
on the reduction of old, 367.
mischief resulting in some cases of attempted reduction of old, 368.
method adopted for reducing old, 379.
complications of old, 381.
Dissolving callus, methods employed in, 58.
Duhamel's theory respecting the formation of callus, 40.

Ecchymosis, a sign in dislocation as well as fracture of humerus, 88.
different seat of, in the two cases, 89.
Elbow, mode of reducing fracture at the, 106.
Enarthrotic joints, dislocation sometimes incomplete in, 73.
Encysted tumour of the lower jaw, 438. See also Cysts.
Epiphysis of radius, separation of, 124.
Equilibrium, mode in which it is preserved in the erect posture, 242.
Erysipelas following fracture of the fibula, case of, 289.
Excision of dislocated extremity of ulna, 127.
Exostosis, at the extremity of the great toe, 409.
of the ungual phalanx of the great toe, cases of, 409-10.
of the great toe, mode of removing, 411.
on either side of the nose, case of, 412.
case of large, from the sixth rib, 413.
Exostoses, case of large, developed on most of the bones, 411.
on nearly all the bones, case of, 414.
not attributable to venereal taint, 415.
Experiments on the tenacity of callus, 57.
proving the power of the ligaments of the foot, 245, 246.
Experiment to elucidate the condition of the humerus in dislocation, 80.
Extension and counter-extension defined, 12.

Faulty, deposit of callus, 40.
Femoral artery tied in fracture of the leg, 27.
seen to cross an abscess of the thigh, 395.
Femur, dislocation of, mistaken for fracture, 10.
fractures of neck of, 21; opinions respecting non-union of, 22. See also Cervix.
fractured by muscular action, 38.
congenital dislocation of, 165.
dislocation of, reduced after thirty-one days, 369. See also Dislocation.
dislocation of, mistaken for fracture, 375.

Femur, osteo-sarcoma of the, terminating fatally, 427.
symptoms of congenital dislocation of, 166.
curious case of dislocation of, 169.
cast of congenital dislocation of, in St. Thomas's Hospital, 168.
fractures of the neck of the, 187. See Cervix.
fracture of the head of the, 192, 205.
Fibula, modes in which it may be fractured, 121.
historical notice of the fractures of the, 235.
causes of fracture of, 249.
case of fracture of the shaft of, 249-50.
analogy between fracture of, and those of ulna, 253.
on fracture of, from indirect causes, 254.
fracture of, from inversion of the foot, 257.
signs of fracture of, from indirect causes, 261.
case of fracture of, marked first by presumptive signs only, 263; indicated by characteristic signs, 266; with dislocation of foot outwards, 269.
varieties and complications in fractures of, 271.
case of fracture of, and dislocation of foot inwards, 274.
fracture of the, with dislocation of the foot inwards, 274.
case of fracture of the, and of the inner malleolus, 275; and tibia, with dislocation of the foot, 276.
fracture of the, complicated with dislocation inwards, 277; complicated with dislocation outwards of the foot, 279; with dislocation and rupture of ligaments, 282; with internal derangement of parts, 284; with extravasation of blood, 285.
comminuted fractures of, 283.
compound fractures of, 285.
fracture of the, with tumefaction, tension, &c., 287; with inflammation, suppuration, &c., 288.
case of fracture of the, followed by erysipelas, 289.
fracture of the, with pain, spasm, and tetanus, 290-1; followed by necrosis, 293; sloughing of tendons not infrequently ensues, 294; adynamic affections consequent on, 294; treatment of, hitherto inefficient, 295; case of, with dislocation inwards, 297; maltreatment of, entailing permanent lameness, 298; curative indications in, 299; vicious practice to delay reduction of, 300; mode of reducing, 301; necessary to relax the muscles in reducing, 301; means for retaining the proper relation of parts in, 302; apparatus employed in, 303; case of, with dislocation outwards, 304; case of, with dislocation backwards, 306; parallel between old and new method of treating, 308; with dislocation inwards and backwards, 308; effects of new plan of treating, 309; with dislocation outwards, terminating fatally, 310; tables of cases of, treated on the new plan, 311 et seq.
osteo-sarcoma of the, 418.
Fibrous tissues involved in caries of the spine, 402.
Finger, spina-ventosa of the, 430.
Fingers, dislocation of the phalanges of, 161 et seq.—see also Dislocation; section of flexor tendon in, 164.
Fistulæ, an explanation of the usual way in which they are formed, 403.
peculiarities in the organization of, 404-6.
mode of treating, in their different stages, 405-6.
are sometimes entirely obliterated, and their remains absorbed, 407.
Flaubert's cases of attempted reduction of old dislocations, 368.
case of fracture of the radius, 126.
Flexion of limbs in fracture recommended, 14.
Fore-arm, analogy between leg and, 120.
dislocation backwards of, 110, 112.
Fracture oblique, of the left leg, 25; of the right tibia, 26, 27.
reunion of, retarded by presence of hydatids, 34.
produced by muscular action, 37.
influence of gout in facilitating, 37.
oblique, of left thigh, 45.
simple, of tibia, 48.
of both bones of leg, 51.
of radius, followed by vicious union, 58.

Fracture of metacarpal bone, 59.
  of radius, followed by defective union, 60, 61, 62, 64, 65.
  of bones of the leg, followed by lateral deformity, 63.
  of shaft of femur, 67.
  of both bones of leg, 68.
  of fore-arm, delayed reduction, 68.
  of neck of humerus, mistaken for contusion, 90; with partial luxation, 91.
  of upper part of humerus, resembling dislocation, 92.
  of the clavicle treated by position, 98, 101.
  of the humerus, treated by position, 99, 100; mistaken for dislocation of elbow, 103, 105, 170.
  near the elbow-joint, 108.
  double, of radius, with compound dislocation of ulna, 127.
  of the radius, viciously united, 136, 138; at its carpal extremity, 141-43; followed by gangrene, 145.
  of the acetabulum, 205.
  of the cervix femoris in a cancerous subject, 193; produced by gunshot wound, 194-5; from a fall on the great trochanter, 215; united and again fractured, 217; terminating fatally, 219; and death from phthisis, 220. See also Cervix.
  of the patella, causes of, 222; mode of production of, by muscular effort, 223; case of, terminating fatally, 224; preservation of its fibrous capsule important in, 225; vertical, not very rare, 225; case of, 225-26 — see also Patella; transverse, cured without separation, 230; case of, followed by gangrene, 231; treatment should be prolonged in, 232.
  of the fibula, its importance, 234. See Fibula.
  of the malleoli, 251. See also Malleolus.
  of the mastoid process, cases of, 331-2.
  of the vertebræ, 353. See also Vertebra.
Fractures, general considerations on, 1; causes of, 3; general remarks on the signs of, 3; division of, 4; general treatment of, 7; reduction of, 10; adjustment of, 13; position in, 14; apparatus for, 15;
Fractures, (*continued.*)
  of radius and ulna, 16; causes retarding union of, 19; oblique direction of, 20; transverse, 20.
  influence of scrofula, rickets, and cancer, in retarding the union of, 28.
  state of uniting, medium in, examined, 47.
  tabular view of, reset after different periods, 69.
  causes of displacement in, 70.
  of radius, frequent, 120; causes of, 124; should be reduced as soon as possible, 139; conclusions respecting, 147.

Gangrene consequent on the tight application of bandages, 145.
Gout, its influence in facilitating fracture, 37.

Hanging, mode of death in, 351.
Hereditary tendency to congenital dislocation of the thigh-bones, 181.
Hey's remarks on fracture of the fibula, 236.
Hip-joint, observations on amputation at the, 423.
Hippocrates, reference to, 1.
Howship's remarks on the treatment of fractures of the fibula, 238.
Humerus, hydatids in the, 34.
  fractured by muscular action, 38.
  difference between dislocation and fracture of head of, 76.
  when reduced after dislocation does not always resume its normal length, 79.
  experiment to elucidate the condition of, in dislocation, 80.
  dislocation of, reduced by Mothe's method, 81-2.
  primary dislocations of the, 83.
  partial dislocation of the, 86.
  dislocation of, complicated with fracture, 87.
  similarity between dislocation and fracture of, 88.
  points of contrast between the same, 88.
  fracture of neck of, mistaken for contusion, 90; with partial luxation, 91.
  dislocation forwards of, 92.
  dislocation with fracture of the neck of, 94.

- Humerus, fracture of, treated by position, 99, 100.
  - fracture of, mistaken for dislocation of elbow, 103, 105, 107; near the elbow-joint, 108.
  - dislocation of, reduced after thirty-eight days, 370. See also Dislocation.
  - method of reducing old dislocations of the, 374, 379.
  - spina-ventosa of the, 428.
- Hunter's theory concerning the formation of callus, 40.
  - observations on newly-formed mucous canals quoted, 391.
- Hydatids, presence of, in bones retarding reunion of fracture, 34, 39.
  - in tibia and vertebræ, 39.

- Indirect fractures defined, 5.

- Jacquemin's, Dr., experiments on the tenacity of callus, 57.
- Jaws, cysts in the, 444 et seq. See also Cysts.
  - osteo-sarcoma of the, 416 et seq. See also Osteo-sarcoma.
- Joints, false, caused by using limb too soon, 24.

- Keel-shaped chest, a congenital deformity, 384.
- Knee, disease of the, and osteo-sarcoma of the femur, 427.
- Knee-joint, injury in fractured patella to the, 224 et seq. See also Patella.

- Lafayette, General, his case (of fractured cervix femoris), 214.
- Lallemant on fracture of cervix femoris, 198.
- Lecat's advice respecting fractures of the fibula, 296.
- Leg, fracture of both bones of, 51.
- Levers which the foot represents, 242.
- Ligament, rupture of the internal lateral, combined with fractured fibula, 273.
- Ligaments of the wrist, relaxation of, 137.
  - of the ankle-joint, remarks upon the, 240.
  - of the foot, experiments on, 245-6.
  - of the foot, case of rupture of, with dislocation outwards and upwards, 282.
- Ligaments, laceration of the cervical vertebral, 339-40.
  - of the vertebræ, diseases of, resembling dislocation, 347.
- Ligature of femoral artery in fractured leg, 27.
- Louis' remarks on fracture of the fibula, 237.

- Malgaigne's directions for distinguishing fracture from dislocation of the humerus, 76.
  - observations on fractures of the elbow, 104.
- Malleolus, separation of the point of the inner, with fractured fibula, 273.
  - fracture of the inner, 273.
  - cases of fracture of the fibula and inner, 274-5.
- Malleoli, fracture of both, 251, 259.
  - fractures of, unite readily, 274.
- Mastoid process, cases of fracture of the, 331-2.
  - remarks on fractures of the, 331.
- Maxillary bones, osteo-sarcoma of the, 416 et seq. See also Osteo-sarcoma.
  - cysts in the, 444 et seq. See also Cysts.
- Mechanism of the ankle-joint, 241.
- Medico-legal questions respecting dislocations of the vertebræ, 349.
- Medullary membrane, the original seat of spina-ventosa, 432.
  - canal encroached on by callus, 42.
  - membrane, altered condition of, after fracture, 44.
- Mercier's opinion regarding the texture of bone at different ages, 190.
  - concerning the displacement consequent on fractured cervix femoris, 204.
- Metacarpal bone, fracture of, 59.
  - objections to removing the head of the, in amputation of the finger, 431.
- Metatarsus, dislocation of, rare, 326.
  - cases of dislocation of the, 326, 329.
  - mode in which it may be dislocated, 328.
  - characteristic signs of dislocation of the, 330.
- Miscarriage not necessarily produced by tetanus, 293.
- Morgagni's cases of fractured cervix femoris, 219.

MOTHE's method of reducing dislocations described, 77.
 cases of dislocated humerus reduced by, 74, 81-2.
Muscles, spasm of the, causing displacement in fracture, 11.
 relaxation of the, most favorable to reduction, 11, 12.
 of the leg, remarks respecting the, 240.
Muscular action capable of producing fracture, 37.

Neck of femur, fractures of, 21, 187 et seq. See also Cervix.
Necrosis, a complication of fractured fibula, 293.
 rarely affects the extremities of long bones, 293.
Nerves, brachial, torn in attempting to reduce an old dislocation, 368.
Non-professional persons, observations addressed to, 8.
Non-union in oblique fractures, their causes, 24.
Nose, exostosis on either side of the, 412.

Oblique fractures, 20.
 causes of overlapping in, 23.
 relaxation of muscles insisted on in, 23.
 fracture of the left leg, case of, 25.
 fracture of the tibia, case of, 26-7.
Olecranon, treatment of fractured, 16.
Organization of callus, 42.
Orthopedic treatment in deformity after fracture, 56.
 in congenital dislocation of the thigh-bones, 184.
Osteo-sarcoma of the femur, case of, 33.
 definition of, 416.
 points of resemblance and contrast between spina ventosa and, 416, 427.
 of the lower jaw, case of, 416.
 distinction between osseous cysts and, 435. See also Cysts.
 of the tibia and fibula, case of, 418.
 of the upper jaw, cases of, 418-9.
 associated with venereal taint, 419.
 conversion of osteo-fibrous tumours into, 420.
 operation for the removal of, from the upper jaw, 421.
 of the thigh, cases of, 423, 425.
Osteo-sarcoma of the femur, and disease of the knee, 427.
Osteo-sarcomatous tumour, description of the dissection of an, 426.

Pain, seat of, a presumptive sign in fracture of fibula, 262.
Paralysis of the bladder, explanation of, in fractured spine, 354.
PARÉ, Ambroise, on fracture of the cervix femoris, 200, 202.
Passive motion to be employed in injuries to the elbow-joint, 112.
Patella, causes of fracture of, 222.
 mode in which muscular action produces fracture of, 223.
 comminuted fracture of, 223.
 injury to joint in fractures of, 224.
 case of fracture of, 224 et seq. See Fracture.
 preservation of fibrous capsule important in fracture of, 225.
 vertical fracture of, not very rare, 225; case of, 225-6.
 diagnosis of fracture of, 227.
 treatment of fractures of, 228.
 appropriate apparatus for fractures of, 229.
PAYEN's case of old fracture of the radius, 134.
PELLETAN's case of fractured clavicle, 101.
Pelvis, development of, uninfluenced by congenital dislocation of thighs, 172.
 tilting of the, may resemble shortening of the lower extremity, 201, 203.
Periosteum, restoration of, after fracture, 45.
Permanent callus, 41.
PETIT on fractures of the cervix femoris, 200, 202.
 his remarks on fractures of the fibula, 296.
Phalanges of the thumb and fingers, dislocation of, 152 et seq.
Pharynx, laceration of the, in dislocation of the sixth cervical vertebra, 342.
PHILLIPS, Benjamin, his cases of dislocated astragalus, 325.
Physiological interest of fractures of the spine, 358.
Position in fractures, 14, 97.
 on outer side in fractured tibia recommended, 27.
POTT, Percival, referred to, 1.

Pott, Percival, his plan in treating fractures, 21.
  his treatment of fractures by semiflexion, note on, 210.
  his remarks on fracture of the fibula, 236, 296.
Pouteau's remarks on fractures of the fibula, 296.
Presumptive signs of fracture of the fibula, 261.
Provisional callus, 41.
  deficiency of, 43.
Pus, character and cause of decomposition of, in caries of the spine, 401.

Radius, fracture of, 16.
  treatment of fractured, 16.
  fractures of, 58, 60, 61, 64, 65, 66.
  spontaneous dislocation of either, 116.
  congenital dislocation of, 117.
  frequency of fractures of, 120.
  fractured at all periods of life, 123.
  usual seat of fracture of, 123.
  separation of epiphysis of, 124.
  double fracture of, 127-8.
  supposed dislocation of, 129.
  signs of fracture of, 132.
  diagnosis of fractures of, important, 133.
  old fracture of, 134, 136, 138.
  deformity in fracture of, 139.
  fracture at the lower extremity of, 141-43.
  gangrene following fracture of, 145.
  conclusions respecting fractures of, 147.
Reduction of fractures, 10.
Reduction, mode of, in fractures of the elbow, 106.
  in dislocations of the fore-arm on the humerus, 111-18.
  of dislocations of the neck, obstacles to the, 337.
  of dislocations of the vertebræ should not be attempted, 345.
  of old dislocations, 367. See also Dislocation.
Richond's experiments on dislocations of the vertebræ, 350.
Rickets, influence of, in reunion of fractures, 28.
Rickety subject, case of fracture in a, 30.
Rib, exostosis from the sixth, 413.
Ribs, case of caries of the, 396.
Rotation of the foot on its axis, in fractured fibula, 267.
Roux's case of compound dislocation of the thumb, 158.

Sacrum, case of caries of the, 396.
Sanson's case of softening of the vertebræ, 394.
Scrofula, influence of, in fracture, 28.
Scrofulous diathesis, case of fracture in a, 28-30.
Sharp, William, referred to, 1.
Signs of fracture of the fibula, divided into presumptive and characteristic, 261.
Skeleton imperfectly developed in congenital deformity of the chest, 386.
Sloughing of tendons, a complication of fractured fibula, 294.
Spine, fractures of the, 353. See also Vertebræ.
  physiological interest of fractures of the, 358.
  caries of the, 392. See also Vertebral column.
Spina-ventosa, points of resemblance and contrast between osteo-sarcoma and, 416, 427.
  characters of, 416.
  of the humerus, 428.
  analysis of the matter contained in, 430.
  description of the dissection in a case of, 429.
  of the index-finger, 430.
  has not been properly studied, 432.
  medullary membrane the primary seat of the disease in, 432.
Spinal marrow, cicatrix of the, 359.
Splint, cubital, in fractured radius, 140.
Spontaneous dislocation of either radius, 116.
Sprains of the wrist, 125.
  of the foot, some remarks on, 255.
  external ligaments of ankle more frequently affected in, 256.
  right side most obnoxious to, 256.
  treatment of, 256.
  tables of, 256-7.
Statistics of fractures, 7.
  of fracture of the fibula and its complications, 311 et seq.
Suppuration following fractures of the fibula, 288.

Tendons, power of, in preventing dislocation at the wrist, 122.

Tendons sometimes slough after fracture of the leg, 294.

Tetanus following fracture of the fibula, 291.
  does not necessarily entail miscarriage, 293.

Thigh, oblique fracture of left, 45.

Thigh-bones, congenital dislocation of, 165 et seq. See also Dislocation.

Thigh, osteo-sarcoma of the, 423, 425.

Thorax, depression of the walls of the, 383. See also Chest.

Thumb, cases of dislocation of the first phalanx of the, 152-9.
  cases of dislocation of the ungual phalanx of the, 160-1. See also Dislocation.

Tibia, oblique fracture of right, 26-7.
  simple fracture of, 48.
  fracture of the lower extremity of the, complicating fracture of the fibula, 275.
  fracture of the fibula and, with dislocation of the foot, 276.
  osteo-sarcoma of the, 418.

Toe, exostosis of the great, 408. See also Exostosis.

Tongue, atrophy of half of the, accompanying disease of the cervical ligaments, 348.

Tonsils, frequently enlarged in congenital deformity of the chest, 385.

Transverse fractures, 21.

Tubercles in bone, 432.

Tumour, encysted, of the lower jaw, 438. See also Cyst.

Ulna, compound dislocation of, with fracture of radius, 127.
  dislocation of the carpal extremity of, 149-50.
  Breschet's case of dislocation of the, alluded to, 151.

Union of fracture, causes which may retard the, 19 et seq.; summary of phenomena associated with, 56.
  vicious, in fracture of radius, 58.
  of fractured cervix femoris, Sir A. Cooper on, 207.

Vertebra, fatal case of dislocation of the sixth cervical, 341.
  dislocation of the fifth cervical, 343; of the sixth cervical, 344.
  case of dislocation of the fifth cervical, 344.

Vertebra, fracture of the sixth cervical, terminating fatally, 353.
  fracture of the tenth dorsal, cured, 356-7.
  fracture of a cervical, first cured, and subsequently fatal, 358.
  fracture of the second cervical, from gun-shot wound, 360; fourth and fifth cervical, from gun-shot wound, 360; twelfth dorsal, 361; last two cervical, 361.
  fracture of the fifth cervical, 362; eleventh dorsal, 362; first lumbar, 363; eleventh dorsal, 363.

Vertebræ, on dislocations of the, 337.
  obstacles to the reduction of dislocations of the, 337.
  dislocation of the first two, admitted by most authors, 338.
  mode in which dislocations of the first two are produced, 338.
  risk in attempting to reduce dislocations of the first two, 339.
  case of laceration of the ligaments of the cervical, 339.
  fatal case of laceration of the ligaments of the lumbar, 340.
  disorganization of the cord, consesequent on dislocation of the, 345.
  attempts to reduce dislocations of the, to be deprecated, 345.
  distension of ligaments resembling dislocation of the, 346.
  disease of ligaments resembling dislocation of the, 347-8.
  medico-legal questions respecting dislocations of the, 349.
  M. Richond's experiments regarding dislocations of the, 350.
  dislocation of the, occasioned by twisting the body in hanging, 351.
  reference to six cases of fractures of the, 364 et seq.

Vertebral column, case of caries of the, terminating fatally, 392.
  case of softening of the, without abscess, 394.
  case of caries of the, with abscess, 395.
  case of caries of the ribs, sacrum and, 396.
  case of caries of the, terminating fatally, 398.
  caries of the, accompanied by phthisis, 399.
  structures involved in caries of the, 400.

Vertebral column, relation between amount of caries of the, and symptomatic abscess, 400.
  definition of caries affecting the, 401.
  anatomical changes in caries of the, 401.
  sacs originally connected with caries of the, sometimes contain adipocere, 402.
  fistulous canals connected with caries of the, 403. See also Fistula.
VAUQUELIN'S analysis of the matter of spina-ventosa, 430.
WEBER'S experiments on the influence of atmospheric pressure in dislocation, referred to, 11.
Wrist, sprains of the, 125; producing white swelling, 126.
  injuries of, require perfect rest, 126.
  relaxation of the ligaments at the, 137.

Zygomatic arch, fractures of the, 333.
  case of fracture of the, with depression, 335.
  fatal case of fracture of the, 335, 336.

ERRATA.—At page 187, line 7, *insert* young *before* adults.
264, — 26, *insert* they *before* may.

THE END.

C. AND J. ADLARD, PRINTERS,
BARTHOLOMEW CLOSE.

To avoid fine, this book should be returned on
or before the date last stamped below

DEC 19 2005

DEC 22 2005

TRANSFERRED TO LANE
LIBRARY FROM ANATOMY

ANATOMY

RD
684
D86
1847
LANE
HIST

LANE LIBRARY, STANFORD

TRANSFERRED TO LANE
LIBRARY FROM ANATOMY

9-

BOUND BY
ESTLEYS &
CLARK.

ANATOMY